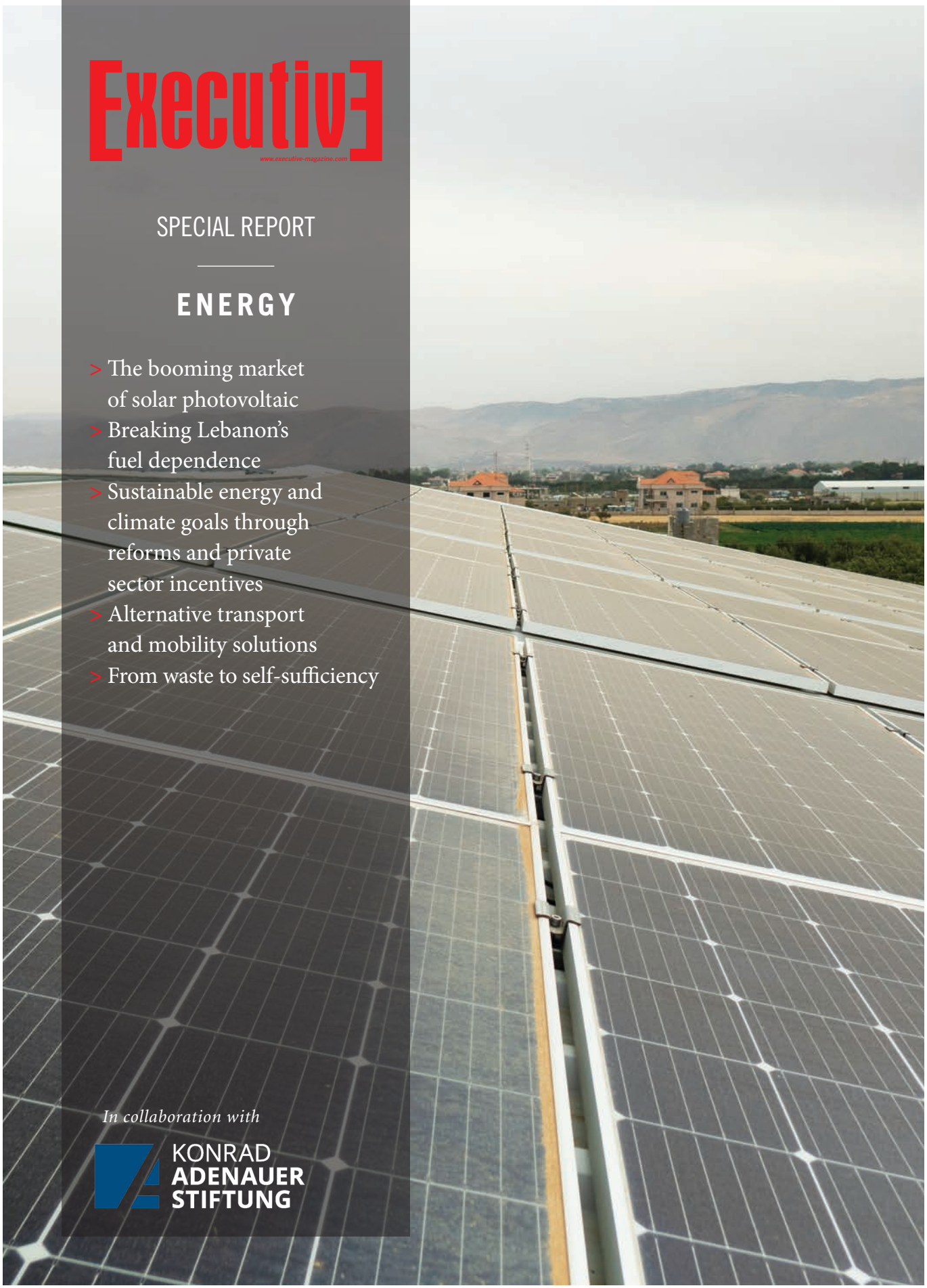

Executive

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SPECIAL REPORT

ENERGY

- The booming market of solar photovoltaic
- Breaking Lebanon's fuel dependence
- Sustainable energy and climate goals through reforms and private sector incentives
- Alternative transport and mobility solutions
- From waste to self-sufficiency

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By Thomas Schellen

THE RACE TO SOLAR

New consumer appetites and old (bad) habits

The supply of growth figures is so poor in Lebanon these days that any economic increase – one that is not a horrid leap in poverty, hunger, unemployment, and inflation – is more than newsworthy. Real, positive growth today is simply sensational. Even if there are hidden ambiguities and foreseeable near-term risks.

In this regard of sheer growth, one fresh green shoot in the economy that promises to be spectacular in the current year, is the number of new solar photovoltaic (PV) projects – albeit with the caveat that it is too early to assess the solar PV sector's growth rate for 2021. However, the signs of a major increase are unmistakable and supported by the fact that already the 2020 annus horribilis of pandemic lockdowns and economic meltdown saw a significant increase in aggregate solar electricity capacity, which contributed positively to the country's needed transition to renewable energy (RE). "Despite everything, in 2020 the Lebanese market [for photovoltaic power] witnessed an increase of 14 MW. At the end of 2020, we had overall 89.84 MW of distributed solar PV," says Rani Achkar, the executive director at the Lebanese Center for Energy Conservation (LCEC).

To sharpen this picture, the current growth is taking place on the level of systems that are being installed by Lebanese households. Noting this

specificity, the increase in the number of installed small off-grid PV systems since the outbreak of Lebanon's multi-tiered crises in 2019, and the expansion of the supplier base offering such systems, make for two rare numbers of, possibly exponential, year-on-year growth by end of December.

And although similarly strong growth figures do not apply to the sector of renewable energy at large and although there has been a weakening of the market for industry or utility-scale solar PV projects, the growth in the residential PV sector could fuel economic optimism renewably over the expected tough years from now to the end of the 2020s. Domestically, it could significantly contribute to the RE resolution of the crippling national electricity problem. In terms of signals to external stakeholders – meaning potential donors, investors and financiers – Lebanon's positive solar impulses moreover come at an opportune time when the whole world is caught up in the need to speed up its RE transition.

This is to note that, with climate action getting more urgent by each month of insufficient mitigation of fossil fuel risks, the RE theme this year tops the global agenda two times: once in form of a High Level Dialog on Energy (HLEDE) at the UN General Assembly in September and then – in the main climate event of 2021 – at the COP 26 summit in Glasgow. As far as global scenarios go, climate risk and the underachievement of the Paris climate goals presently appear on course to supplant the pandemic fears and COVID-19 infodemic as the chief worries.

ASSESSING THE LURE AND THE RISK

All in all, the theme of renewable energy is hotter than the sun on a Lebanese beach in August, and this makes the new local vigor in adoption of RE and specifically solar PV, all the more enticing. Irrespective of its national drivers. Of course, from the in-country perspective, the reason for the local solar demand boom is as self-evident as the human need for electricity: since this spring's epochal and near universal collapse of national supplies by the electricity utility Electricité du Liban (EDL) and the simultaneous onset of serial diesel price shocks and subscription fee hikes in the country's informal secondary electricity supply scene of private diesel generators,

■ [Based on] the size of consumer demand [...] the popular will to be solar looks strong, but so does uncertainty

households have been scrambling to find power and energy safety, notably not heeding the sustainability and climate importance of the solutions they acquired.

But how large, how economically durable, and how sustainable then is this hunger for RE? From a first proxy assessment of the size of consumer demand on a proxy number of weekly phone inquiries and requests for advice to the LCEC, the popular will to be solar looks strong, but so does the uncertainty. When comparing people's PV inquiries to LCEC in 2021 to 2018, which multiplied from one phone call a week back then to an average five phone calls a day this year, Achkar alludes to a 25-fold jump in customer interest seen by the country's public sector RE institution, before clarifying that the leap up "will be in number of projects. Most of the new installations will be small residential installations. In terms of installed capacity, the [2021 numbers] may not reflect the huge increase in project numbers."

Judging from the number of new market entrants on the supply side, the increase also is "huge," says Walid Baba, president of non-profit association Lebanese Solar Energy Society (LSES). According to surveys, the first of which he had undertaken in 2001, company numbers that entailed importers and all sorts of services providers in solar technologies, grew from 26 companies in 2001 to over 100 at the end of the 2010s. "In the crisis, another 100 can be added. So in one year, more companies came to market than in the previous 20," Baba tells Executive.

Further anecdotal evidence to corroborate this boom on both the retail demand and supply side of solar PV systems is easy to find from private sector companies. Leaders of the small solar industry tell the story. For Rabih Osta, vice president of Phoenix Group (member of INDEVCO Group), the LCEC can call itself lucky to receive a mere 25 calls per week. "We receive 500 calls a day," he tells Executive about the demand storm experienced by staff at group unit Phoenix Energy.

Renewable energy company Ecosys, an ITG Group unit and another of the industry majors, signed contracts for about 100 residential solar solutions over approximately two months in the third quarter of 2021, discloses George Geha, chairman and general manager of Ecosys. By contrast, between the company's incorporation in 2008 and end of last year (notably a period in which the company was focused on supplying larger systems to the Lebanese corporate markets) the total count of its residential market contracts was in the single digits – between five and ten.

At independent solar PV solutions provider Novaenergia, managing director Joe Hawi confirms that "there is a lot of noise" about demand and supply of residential solutions. "The market went from low activity to hyper activity in a matter of days, after the generator cuts in this spring," he says, qualifying the overall demand picture by adding, "The market evolved into [three] segments, those who can afford something good and those who cannot, plus those who could [buy quality] but would not."

The list of testimonials and anecdotal evidences goes on, to the point that the solar PV fever seeps from corner shops. Noticing, on an unrelated business visit to my neighborhood OMT agent, a fairly large box sitting on the floor besides his display case of his usual product range, smartphones, I ask Mohammad, the shop's operator, "Oh, you have got yourself an inverter now?" He proudly responds, "Not just an inverter; I just got a container shipment in that is full of all components, inverters, batteries and photovoltaic panels. They are next door and I have started a new business selling solar PV systems."

> "The market went from low activity to hyperactivity in a matter of days, after the generator cuts this spring"

He adds that he is advertising on Facebook and has immense interest from electricity-starved people, but concedes, "People are asking many ques-

tions about price and when hearing about the cost of getting solar, most are no longer interested."

From an economic perspective, this entire scenario of course fits the definition of a positive demand shock in a textbook way. The implication is that short-term distortions and mid-term repercussions – vulgo, supply shortages and price increases that are followed by unsustainable investment moves and creation of oversupply – are highly probable or, in the case of price distortions, already in full swing.

As example for the latter, Hawi says he has seen offers in the market where importers were upping the wholesale prices of deep cycle batteries at the lower end of the quality range in the neighborhood of 30 percent, and installers added another markup – for batteries that the East Asian manufacturers would sell internationally at unchanged dollar prices. In Hawi's view, the upward price distortions are highest in the lower quality segments where incidental demand is currently at peak and supply tight because of the unexpectedness of the demand surge.

There are expectations that the local supply squeeze will relax in the first quarter of next year, but compounding the impact of the local demand shock in the near term also could be factors such as increased international shipping costs and global supply chain bottlenecks.

For another contributing element, Ecosys' Geha points to the fact that the residential market's structure of many small individual projects puts quality suppliers in a bind because they need to achieve higher margins per system due to their long-term warranty obligations and maintenance commitments. Like his industrialist peers that have developed the sector, Geha expects a negative impact on the reputation of solar PV markets from the current madness but does not believe it will damage Ecosys itself. "I am not afraid of that because the Lebanese market is small and there is a differentiation between one [supplier of solar systems] and the other. People will pinpoint that one is good and other bad, and there will be a filtering," he says.

Repercussions from the current market chaos will still be felt after years, exclaims Phoenix Group's Osta. "There are a lot of leads and deals, but it is chaos that is going on. And people who install under-capacious system today will, after nine months or one year, experience many problems with their systems either in terms of performance and lifetime, or safety and security. Consequently, people who are not knowledgeable in renewable energy will start seeing it as something that is not recommended. I cannot comprehend how [some vendors] are promoting systems only based on amps, without [explaining] autonomy, and other factors," he says.

THE URGENT NEED FOR STANDARDS

That the newcomers in the industry represent a factor of new uncertainty is also not a fact lost on LCEC Executive Director Achkar, although he paints a differentiated picture of the incoming suppliers. "We are seeing a lot of new companies with good ethics and good sizing of the systems," he says. Those companies' offers, as far as examined by LCEC experts upon client request, explain in a clear way what clients will be purchasing, Achkar adds, but acknowledges that LCEC also has seen offers that were "very ambiguous." Other offers were clear in technical data "but with misdirection in the phrasing of the offers," he says. According to him, such phrasing might make people rely on ampere-based solar PV system descriptions which include no information on storage. Such systems subsequently will not meet people's unrealistic expectations. "There is some misdirection of the users," he concedes.

> In the opinion of old-established industry players, higher standards [for quality checks] would in any case arrive too late to inform the current demand

Conversations on standard setting and technical supervision of solar PV vendors have, according to Achkar, been initiated with the Order of Engineers in Lebanon but it does not sound as if a quality check process of provider qualifications would be forthcoming soon. In the opinion of the old-established industry players, higher standards would in any case arrive too late to inform the current demand.

Baba and Hawi say that the problems of missing standards and unsound operators have existed for a long time. According to Hawi, the latter has actually been present since he entered the sphere of RE in 2010 but it was subdued because most consumers were not ready for solar and financing by local lenders was discriminatory on the technical prerequisites and quality of financing deals in the sense that the banks preferred to award subsidized solar PV loans to well-off clients who did not really need such loans. "We saw the number of solar

companies increase with time. There being no real regulatory authorities in Lebanon to mandate any technical or quality control, there were moments when we felt that some people cut corners but in general, it was a small and competitive market," he describes the sector's growth throughout the 2010s.

He further opines that the factors driving the market in the early years were far from the current despairs. In the early to mid-2010s, the strongest pro-PV impulses could be attributed to green lending subsidized by the Lebanese central bank, Banque du Liban (BDL), and offered under the name National Energy Efficiency and Renewable Energy (NEEREA) loans; were furthermore correlated with fluctuating oil markets; but were helped the most by international development actors. "Market catalysts were UNDP, government tenders, NEEREA loans and in very rare cases, cash upfront clients. One interesting thing was that fuel prices were very high in 2013 and 14, and this was reflected in the market," he recalls.

In terms of the effects of the current boom, he foresees more positive than negative outcomes. "The current situation is positive in general, because as dark as it looks when it comes to quality and design, people are purchasing their education on the topic."

Accounting for the wide variety of views and current experiences, however, it seems at this point that not only did the more than two decades long experiment in anarchic capitalism in Lebanon's conventional power sector failed most painfully but also that the conversion of the anarchic capitalist failure into an alternative and orderly development path did not take place. In too many ways, the people's scramble for electricity solutions from either new and untested solar PV vendors and the continued and necessary – for many Lebanese inescapable – existence of a systemically corrupt private power generation sector that in popular perceptions has the markings of a "generator mafia," looks today like a renewable anarchy.

NOT THE MOST EFFICIENT ROUTE

The upsides of the growing solar awareness and household demand in recent months notwithstanding, RE stakeholders interviewed by Executive for this story from the public, private, and third sector question or deny outright that the boom in the sub-sector of residential PV will either last beyond the coming few years or suffice to build the RE industry up to its full potential and the national needs.

Geha says the sudden growth of the residential market was expected by the company but happened without plan. Nonetheless, he expects the addressable residential market to have grown to about 100,000 households over the coming five years, or encompassing 10,000 to 20,000 potential installations annually. On the downside of the current situation, Geha sees bargain-seeking users of as misserved and possibly endangered by suppliers who cut corners, perhaps even in such basic infrastructure issues like the mounting of the support beams needed for rooftop PV panels, and says he imagines with horror what would happen if a panel were to be ripped from a Beirut residential high rise rooftop in the upcoming rain and wind season

> A prudent path of migration to efficient [renewable energy] for Lebanon would firstly be through utility-scale projects up to the gigawatt level

and were to crash in the street below.

Viewed from the system efficiency angle, the emerging sphere composed of small, off-grid systems and de-facto tiny and private solar islands is by Osta's analysis the most unsuited for satisfying national RE interests in the longer term. "The most expensive way how solar power can be generated is to get solar with storage battery at a very small scale," he laments.

Pointing out that this observation applies only to the rush of small-scale projects, he explains that a prudent path of migration to efficient RE would firstly be through utility-scale projects up to the gigawatt level, and a second-best path could be taken by way of motivating commercial and industrial entities to install solar PV at their scale. The latter would be a strong option on basis of laws and regulations that open the national electricity market for wheeling (transporting electricity via the grid to agreed destinations for a fee) and for feeding the electricity into the grid and selling it to the state utility (see Christina Abi Haidar's article page 36).

Following these two prime options of realizing utility-scale mega projects and incentivizing industry-scale PV projects, "the third best way would have been by working towards the replacement of heavy fuel oil with gas in the power plants, and the least optimized one is on the individual level with one, two, or three kW on the top of the house in combination with a storage battery, especially given the fact that in most of the cases, the storage battery is not up to level and quality that is required," he elaborates.

The industrial stakeholders and two United Nations Development Programme (UNDP) affiliated experts are in agreement that the root of the renewable anarchy of 2021 is the fact that installing PV was not a financial, economic, ecological, or climate choice but forced by the people's emergency need to find any sort of electricity.

UNDP Cedro's Harajli notes that the overall RE development (during more than a decade where Lebanon was faced with one problem aft the other) has not been as cyclical and circular as desirable and that the disequitable process of the RE transition was not at all made smoother by the fact that people's latest electricity choices have been dictated by necessity. "People and government have no choice, they cannot continue as usual," Harajli tells Executive.

His UNDP colleague Vahakn Kabakian, climate change advisor attached to the Ministry of Environment, adds that 15 years of Lebanon's government trying to make people buy into solar somehow did not result in a significant shift into PV on the residential level. "The investments in small solar that we are seeing today are not the result of government policy but a result of government collapse," he puts the discrepancy between the government's success in advocating solar acceptance and the people's decisions for solar to the point.

No one who graciously conversed with Executive in some seven hours of recorded interviews for this Energy Special Report and no expert contributor to the report ever suggested that the forward path to RE can best be trodden without concerted strategy and with a government in collapse.

DANGLING ON THE GOVERNMENT CLIFF

Here then comes the habitual and thus anticlimactic cliffhanger in Lebanese government-related stories. The cliffhanger of great promises and intricate strategy plans.

> The commitments to installation of 30 percent renewable energy capacity [were] also received with shrugs of uncertainty

The plans exist (delve into the next act of Solarius for more) and are centered on Lebanon's commitment to climate goals and Nationally Determined Contributions (NDCs) to achieve 30 percent RE capacity by 2030. "In the updated NDC, there is an official environmental commitment of Lebanon to pursue renewable electricity, renewable heat, and energy efficiency," Achkar confirms.

To say it directly and remove the suspense over the expected responses from interviewed RE stakeholders, the commitments to installation of 30 percent RE capacity over the coming nine years, including 4,000 MW in large RE projects in the latter part of the period, were described as music to their ears by members of the solar industry but also received with shrugs of uncertainty.

"The will alone will not make the projects happen. The will is a first step. You have a will, then a plan, then the financing of the plan, and then the right methodology to execute such utility scale projects," Osta says while Geha comments, "To be really able to grow and talk about targets and plans, there is a resolution to the Lebanese status [needed], signed with the IMF. Then things will move quickly."

Checklist

By UNDP Lebanon

In collaboration with
KONRAD ADENAUER STIFTUNG

SOLAR ENERGY: WHAT TO BUY AND WHY?

10 questions to ask your solar energy provider before you commit

1. *How do I assess my home energy needs?*

It is important for the vendor you choose to guide you on assessing the load of how many appliances/ devices you want turned on simultaneously, which would inform your choice of inverter, as well as on assessing and determining your home's critical load and how long loads could be used for (hours of operation). This would inform your choice of the battery bank size and type (Lithium or Lead-acid). A good way to assess your energy needs is if you have a meter installed to track your current generator's input. This would be a good starting point, as well as a personal audit on what your home considers a critical load. Critical loads are a selection of appliances or devices that you believe would require continuous energy supply or in other words require back up when the power grid fails. These need to be separated from other loads and connected to a different sub-panel. Non-critical loads are electrical devices connected to the main panel that will not be backed up during grid failure.

2. *Can I install Photovoltaic (PV) panels without batteries?*

If you have no other choice, you can install PV panels with no batteries, but you will only be able to convert energy directly to your home's network when the sun is shining and there is now way to store energy.

3. *Can I get rid of my diesel generator once I get solar?*

While many people would like to install a PV energy system to discard their diesel generator costs, it is unlikely that the solar energy system will secure your home's continuous and complete energy needs, unless you make a large investment in the battery bank (size and quality).

4. *Do you have any installation examples from a home similar to mine?*

There are many companies out there now, we advise that the company you choose to install your system can show-case their experience and proven record. Try to make sure that the company you are contacting is specialized in solar PV design and installation.

5. *Do you have any references I can call?*

If possible, it would be great to ask for references of similar projects installed for other homes that have similar needs to yours.

6. *What is the duration of the manufacturer warranties on the different components?*

Ask for the duration of the manufacturer warranties of each of the main components. Typically, warranties are up to 25 years for PV panels, 5 years for inverters, 2 years for controllers, 1 year for Lead-acid batteries, and 5 years for Lithium-ion batteries.

7. *What type of battery should I go for?*

While Lead-acid batteries are widely available and cheaper at first glance, and Lithium-ion batteries are a relatively new technology, there are many factors that distinguish each choice which can help guide your decision. Ask about the space required to store them, the charging time, the ventilation and temperature requirements, the percentage of battery capacity discharged, and compatibility with inverters, all of which directly impact cost.

8. *Do you provide after sales services and maintenance?*

Make sure the company you select to install your solar system can provide after-sale maintenance and customer support. You will need a yearly checkup after installation.

9. *Does the system have local or remote monitoring?*

Make sure to ask if the installed system would have a local and/or remote monitoring system. Keeping up with battery use, power-blackouts, critical loads can sound like a lot. However, a good system that is designed around your needs would help you to maintain the system optimally. Remote monitoring systems will help avoid improper care and overuse of batteries which is often a common source for failure in electrical off-grid systems. This is a feature that can help you prolong the lifetime of your system or troubleshooting it when needed.

10. *When would the (full) system be up and running in my home?*

Last, make sure to ask how long it would take for the entire system to be up and running and get that timeline in writing.

In collaboration with
KONRAD ADENAUER STIFTUNG

By Jessica Obeid

POWER SEIZURES

Navigating the chaos of decentralized power generation and distribution

Lebanon is witnessing a rapid deployment of decentralized renewable energy. However, this movement is driven by fear of a total black-out and is happening in the absence of policy, regulatory and financial incentives. This leaves the booming market in total chaos and requires several measures to attenuate its effects, starting with better awareness.

The world is increasingly moving towards decentralized energy generation. This was bound to pick up in Lebanon for different drivers than the global movement. These drivers could be summarized by: 1) a total policy failure leading to more power outages, and 2) an eventual hike in electricity tariffs leading consumers to seek alternatives. The first is being witnessed across the country and the word on the street is that the second is on its way. In all cases, the decentralized energy movement has taken off.

Lebanon's economic, financial, and political crises are taking a toll on the power sector. The foreign currency reserves necessary for fuel imports are shrinking amid complete inaction from the succeeding governments. Protesters are demanding power stations transmit the limited power supply into their regions, thus negatively impacting the grid and power quality. This results in drastic power outages from both the national utility side and the informal private diesel generators that have proliferated across the country since the early 1990s.

The political class has chronically used the electricity sector for vested interests, including corruption and power. Electricity provision has historically been unequitable, characterized by regional disparities in terms of length and quality of power supply. Some political parties are currently using

their influence on the sector to win constituents ahead of the 2022 elections by providing higher electricity supply hours to their areas of dominance. Before the crisis, the farther a consumer had been located from the administrative part of the capital Beirut, the longer the outages and the weaker the voltage. This had led to a bigger reliance on diesel generators outside Beirut. As power outages increased earlier this year, the capital found itself with a power supply nearing only 2-3 hours a day at some periods, similar to the case in other regions.

DEMOCRATIZING DECENTRALIZATION

Whereas in the past a neighborhood diesel generator would "fix" this national utility outage problem at a significant cost, shrinking foreign currency reserves mean that even the private generator owners have limited access to diesel to power those generators. In addition, generators are designed to provide back-up power supply and are not intended for continuous operation. Therefore, the growing hours of outages from the utility side result in growing outages from the generators' side as well, along with higher replacement, operation, and maintenance costs of the generators. This cost would also be passed from the operator to the consumer. In most cities and villages, the consumer is now paying a tremendous bill without receiving a continuous, reliable power supply in return, and is therefore seeking refuge in alternatives, mostly rooftop solar photovoltaic systems.

As a result, Lebanon is witnessing a rapid deployment of decentralized renewable energy. However, this rapid movement is driven by fears of repeated total blackouts and insecurity, both on the energy and political fronts, and is happening in the absence of policy, regulatory, and financial incentives.

The global drivers for decentralized renewable energy have included the existence of policy interventions and enacted legislation, and the availability of feed-in tariffs, price guarantees, and financing mechanisms. By contrast, Lebanese residents, who have lost access to their savings and bank accounts, are having to pay an elevated cost in hard currency due to the mostly imported renewable energy system components, amid a continuing devaluation of the local currency.

The consumer is now paying a tremendous bill without receiving a continuous, reliable power supply in return, and is therefore seeking refuge in alternatives

CONSUMER UNAWARENESS

But that's not the biggest problem. Consumers paying a hefty cost for a system and being completely oblivious to the specifications and quality of their system, is a major concern, and is driven by the lack of awareness and regulation. The critical factor for most consumers in purchasing a system is of course the capital expenditure. But the capital expenditure depends on system size, technology type, components quality, standards, certifications, lifespan, and prospects for operation and replacement of components.

There are different technology types and specifications per system component, and their impact on the system lifespan and the interconnection with the grid, or lack thereof, is significant. Add to that, a booming market attracts plenty of new players. Dozens of companies are now operating in the field, many with poor or no track record. In these conditions, assuming the consumer would do the homework and learn complex technical details to make a sound purchase decision is unrealistic.

The result is a chaotic market with a wide range of technology types and grid implications, and product quality ranging from mediocre to high-end, in addition to the dissemination of under-sized systems and overpromised outputs. This creates a risk for the grid and the systems' performance and a hazard for the safety of the consumers, especially when dealing with electrochemical materials such as batteries.

page 36). There are two major risks in legislations in Lebanon however; the first is that laws often get diluted, enacted as a couple of articles which would be open to future interpretation, and the second is that many laws do not get implemented. Thus, ensuring there is a full-fledged comprehensive law that details different models and incentives for distributed energy generation is needed, and advocating for its implementation is a must.

More complex in terms of implementation is the regulatory body for decentralized power distribution. The power sector lacks a regulator and the country is beset with patronage and bureaucracy. Any attempt to govern and regulate decentralized renewable energy systems without a credible, independent, and strong regulator backed by strong institutions with clear mandates will end up swept under the rug of bureaucratic maneuvering and favoritism.

Financing mechanisms at this stage are obviously dependent on a sound financial solution and package for the country. But 19-months since the default on eurobonds, the prospects of this are decreasing with each passing day of inaction. However, establishing a Green Investment Facility is within the Lebanese Government Financial Recovery Plan. The facility could be designed as a revolving fund or blended finance and capitalized through the Special Drawing Rights allocation from the International Monetary Fund, aid for energy projects through international donors, and private sector.

The biggest opportunity for Lebanon presented by decentralized renewable energy in its various forms from mini-grids and hybrid systems to rooftop solar is that these systems bypass the political bottlenecks that have inhibited reforms in the power sector for decades. Yet, ensuring the rights of consumers are protected, while safeguarding the grid operation and offering just opportunities for the private sector are major requirements for building a healthy market and overall sector.

1 TBSP. EDUCATION, 1 TBSP. REGULATION, 1 CUP FINANCING

Where do we go from here? Ideally, there should be an awareness campaign, a regulatory body, a comprehensive law, and a financing facility.

The awareness campaign should be straightforward and should include details on system sizing and operation and components technologies, types, and specifications, documentation, standards, and maintenance and operation requirements, what to look up for and what to consider in pricing (see page 18).

A comprehensive decentralized renewable energy law is more complex. Yet, a corresponding draft law has already been prepared and the relevant parliamentarian committee should be discussing it as soon as the Ministry of Energy and Water approves it (see Christina Abi Haidar's story

> Dozens of companies are now operating in the field, many with a poor or no track record. Assuming the consumer will [...] learn complex technical details to make a sound purchase is unrealistic

Jessica Obeid is a Beirut-based energy consultant, former resident fellow at Chatham House-London, and former chief energy engineer at UNDP-Beirut

By Gaelle Mounsef

A MOMENT IN THE SUN

Inching towards higher reliance on solar energy

Over the last couple of years, Lebanon has become most notorious for its electricity sector. The country has struggled to keep the lights on since the civil war, and has hit its worst milestone with a complete blackout in October 2021. On its own, the state-owned company Electricité du Liban (EDL) has never been capable of satisfying national electricity demand, wreaking the havoc the country now faces. While Lebanon depends directly on fuel imports as a means of energy production, EDL accounts for reported yearly deficits of around $2 billion. The company is also subject to global oil price fluctuations, feeling the impact of the global energy crisis in the third quarter of 2021, as well as government caps on oil purchases, which directly and indirectly impact the national economy. Relying less on oil and gas imports and more on renewable energy (RE) sources, particularly solar energy, will manage to reduce Lebanon's alarming balance of payments deficit and prevent further blows from market shocks, due to the fact that RE is largely a domestic source of energy.

In March of 2019, the Lebanese parliament ratified the Paris Agreement[1] under law 115. Lebanon committed to covering 30 percent of its energy consumption from renewables by 2030, requiring the installation of 4,700 MW of renewable energy projects, namely solar, wind, and hydro.[2] Such projects would reduce the electricity costs by around 50 percent, as well as lower pollution levels, create jobs, support rural development and eco-tourism in remote areas, and spur economic and industrial growth thanks. They would also allow Lebanon to achieve energy security and stability. This idea presents itself today as a solution independent of institutional reforms. This idea stems from Lebanon's sunny climate which provides around 3,000 hours of sunshine per year, and should be mainly focused on solar energy, which in terms of costs for production is estimated at around $0.04 – $0.05/kWh for utility scale projects; and around $0.07 - $0.08/kWh when storage (batteries) is included. By comparison EDL's average production cost, comes out to around $0.14 - $0.16/kWH. The demand for solar energy has already increased by factories and companies, with the aim of reducing electricity costs.[3]

DECENTRALIZATION AND IRRADIATION

Usually when discussing solar power, people often refer to photovoltaic (PV) cells, the black panels that are attached to the roofs of houses or are used in solar farms. This type of solar panel is composed of a layer of N-type silicon and P-type silicon with a conductor linking them; however, efficiency can vary greatly. Traditionally, running conventional power cables from a central source such as EDL towards remote areas is an expensive ordeal, and approximately 30 percent of electricity generated is lost during transport. Solar power; however, can be distributive which means households, schools, hospitals and/or municipalities can install panels and run cables only the short distance to the inside. In rural areas, for example, the cost of solar energy becomes cheaper and more efficient than centralized power sources.[4] Solar PV is already an established sector in Lebanon with a decent number of competitive private companies adopting it. The growth potential remains significant. The International Renewable Energy Agency's (IRENA) Global Atlas for Renewable Energy indicates that annual average solar irradiation in Lebanon ranges between 1,520 kWh/m²/year and 2,148 kWh/m²/year, with most regions being above 1,900 kWh/m²/year. Based on this, IRENA estimates a potential utility scale solar PV of 182 GW.[5]

In addition to its lower cost and ability to ensure energy security, solar energy has the potential to enable local development and boost innovation in rural areas and across the country. Installing solar and other kinds of renewable energy projects requires well situated land, areas such as in Hermel, Ras Baalback, Tfail, the Chouf, Rachaya, Aqoura, and Taraya. These regions are some of the poorest in the country, and allowing for Power Purchase Agreement (PPA) projects to take place in these regions would help their development, a study conducted by the Lebanese Foundation for Renewable Energy (LFRE) found that approximately 2,700 permanent jobs can be created from RE projects, with two thirds in underdeveloped areas. Moreover, Lebanon's reliance on highly polluting fossil fuel plants has caused a series of environmental and health problems on the national level. Needless to say, neither the people nor the environment are reaping any benefits from this.

As the country plunges deeper into economic collapse and with the long foreseen energy crisis now here, renewable energy technologies offer the prospect of stable and clean power and heat systems. Solar energy in particular will not only reduce the national budget deficit by decreasing fuel imports, it will also ensure greater stability and energy security, benefiting the country on the economic and social levels. To reap its benefits at this critical period in Lebanon's history, necessary steps need to be taken in order to support the uptake of renewables.

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"SOLAR ENERGY: A SOLUTION FOR LEBANON"

Levant Institute for Strategic Affairs (LISA)

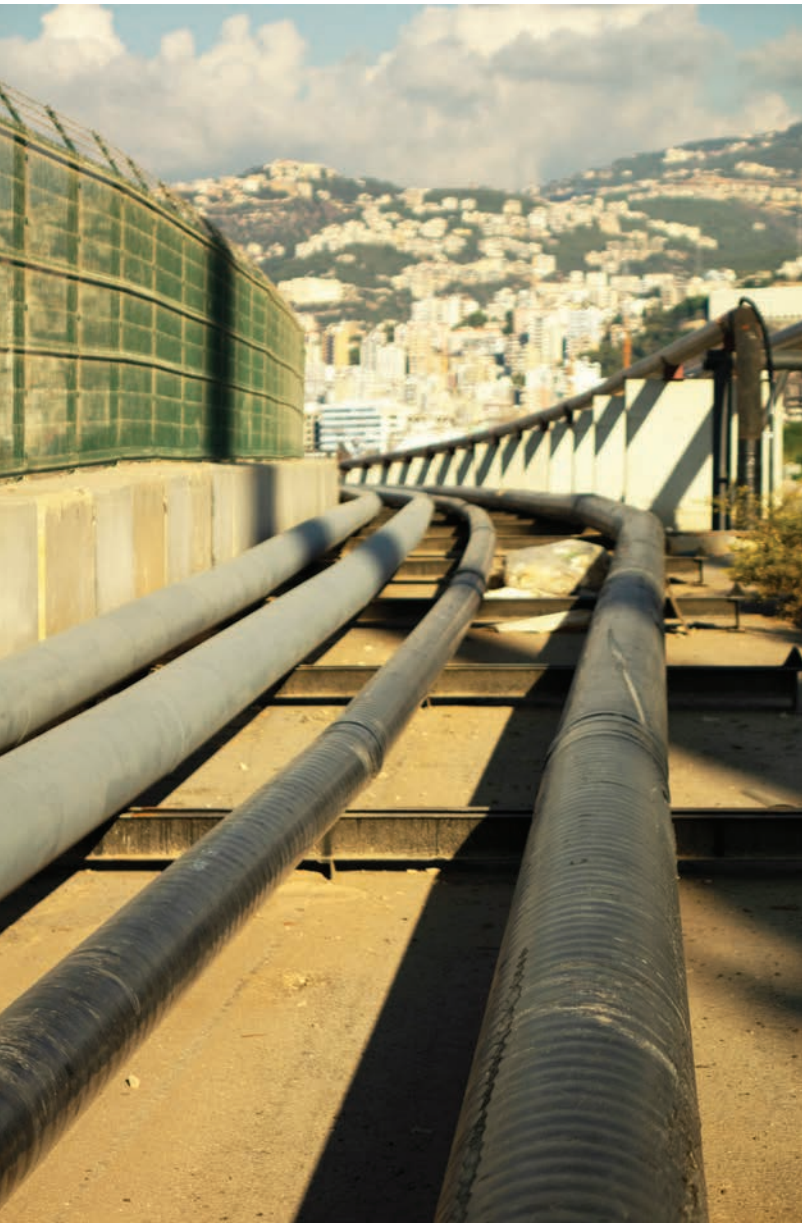
Lebanon needs to take advantage of the current power crisis to move towards decentralized energy production and reform EDL at the technical and administrative level. Major recommendations mentioned in the LISA policy note to kick-start solar energy uptake include:

- Allocating part of the USD 1.135 billion in Special Drawing Rights (SDRs) allocated by the IMF towards investment in solar energy projects through dedicated solar energy funds.
- Developing a conducive policy environment that will contribute to capitalizing on the use and benefits of solar energy. To date, no permits for Independent Power Producers (IPPs) have been given by the government to build utility-scale projects and these permits need to be issued ASAP.
- Installing solar panels on the rooftops of school buildings as a means to support the education sector. A study[6] conducted by the Lebanese Foundation for Renewable Energy mapped 2,561 educational buildings and found that installing solar PV on their respective rooftops would generate 455 MW of clean energy. The government should use part of the SDRs to build solar PV installations on school rooftops in order to guarantee an education for Lebanese children and evade any future fuel crisis the country might face.
- Utilizing existing micro grids of back-up generators to scale-up solar energy on the short term. Given their extensive network and efficiency when it comes to supply and cost, the existing micro grids hold significant potential in being used for solar energy. If these generators along with their grids were to be bought out and transferred towards the municipality, there is potential for further investment. Currently, municipalities cannot take loans to scale up these investments. Therefore, laws linked to decentralization to allow municipalities to undertake such projects need to be formulated and implemented as soon as possible.
- Paving the way by the government for smart and clean grid solutions through modernizing and stabilizing the grid. Modernizing the grid can provide greater quantities of zero-to-low-carbon electricity reliably and securely, including handling the intermittency of renewables like solar and wind power. In addition, investment in base load power is a pre-requisite to scale up renewable energy and reach our 2030 targets. This can be achieved

[1] The Paris Agreement
[2] Renewable Energy Outlook: Lebanon
[3] Renewable Energy in Lebanon: Can the Country Embrace its Resources Sustainably?
[4] LEAPFROGGING AND SOLAR ENERGY
[5] Renewable Energy Outlook: Lebanon
[6] "Assessment for the potential of solar energy on Schools Rooftops in Lebanon" (2021)

By Thomas Schellen

GLOBAL OBLIGATIONS, BIG GOALS, AND MISSING PARTS



Sketching the landscape of Lebanon's booming solar energy market

The Lebanese government at time of this writing has at its disposal several tools, albeit non-financial, that are ready for deployment in the migration to renewable energy (RE). Two are national law projects: the yet-to-be-applied electricity law No. 462 dated 2002 and a new draft for a distributed renewable energy law (DRE law, see story by Christina Abi Haidar page 36). According to independently made remarks by Hassan Harajli, head of the United Nations Development Programme (UNDP) Cedro project, and Rani Achkar, executive director of the Lebanese Center for Energy Conservation (LCEC), Law No. 462 is in need of, however rapidly doable, updating and activation; the DRE law is in Harajli's words "extremely important" for solar photovoltaics (PV) on the industry scale.

The top two other relevant tools in the official Lebanese kit are the updated National Renewable Energy Action Plan (NREAP), which according to Achkar was last month in the final stage of being readied for circulation among stakeholders in RE strategizing, and the updated Nationally Determined Contributions (NDCs), the climate commitments which Lebanon has taken at the end of October to the United Nations' COP 26 summit in Glasgow.

At the heart of these plans and commitments is the target of boosting sustainable electricity generation and achieving 30 percent RE capacity by 2030, meaning capacity that would satisfy the, under pre-crisis calculations for 2030 expected, demand to almost one third. Details on the shares of different technologies for reaching this overall target are laid out in the related 2020 Renewable Energy Outlook for Lebanon that was prepared in a collaboration of the Ministry of Energy and Water (MoEW), the LCEC, and the International Renewable Energy Agency (IRENA), Achkar tells Executive.

The major technology-specific target data stated in the IRENA publication reflect the sunny disposition of Lebanon in proposing about two thirds of renewable power to come from solar sources in form of 2,500 MW of centralized (utility-scale) and

500 MW of decentralized solar PV, a small share of concentrated solar power (CSP, a solar thermal technology not to be confused with centralized solar PV), 1,000 MW of wind, and 601 MW of hydro.[1]

The new edition of the NDCs has already earlier this year been submitted to the United Nations Framework Convention on Climate Change (UNFCCC), and reportedly Lebanon was the first country in the region to fulfill this step. "This paper includes a conditional element of 30 percent renewable electricity by 2030, in addition to objectives for renewable thermal energy, heating and a target for energy efficiency," Achkar elaborates. He explains that the term "conditional" in this context means that the targets are contingent on obtaining international support. "Without international support, targets are lower," he adds.

DETAILS, SERIOUSLY

According to Achkar, the near push in this quest for RE shall be realized in the form of more than 500 MW in installed decentralized solar PV, and the leap to more than 4,000 additional MW in RE will come, on the utility scale, between 2025 and 2030. With these lofty targets also having been officially stated at the recent HLDE event by brand new MoEW, Walid Fayyad, and perhaps a little emboldened by the flabbergasting growth in the number of domestic new solar PV installations this year (see Act 1), the eyes of the LCEC appear committed to looking in one direction, which is straight ahead.

Achkar appears undeterred by failures of recent years to realize either a long-envisioned wind farm project in North Lebanon's wind-kissed Akkar region, the lengthy technical and administrative preparation of which he describes as a practically inevitable learning process, or to launch a utility-scale set of solar PV projects across different districts that were designed to provide a total of 180 MW from 12 solar PV farms.

According to George Geha, general manager of RE enterprise Ecosys, the company was among the winners of the tender because it offered the best bid for a project in the Bekaa thanks to intense bid preparations and a design that used a tracking system for the solar panels. Despite all the effort, the win was incomplete. "The tender outcome was announced with us as winning bidder but we did not sign any contract because we were in the last phase of negotiations when the [financial] crisis came. This type of project needs international financing but there is no more banking sector and no international financial institutions that are willing to lend money to this country and to Lebanese organizations," he says.

This alludes to the first of three serious hurdles that have to be overcome if the Lebanese RE aspiration is to be achieved in full or large parts. These three hurdles are access to finance, resistance to change, and the need for new behaviors. Note, none of these hurdles is exclusively political.

Resistance to change has a massive political component. At the bottom line, however, resistance to change and the need for new behaviors apply to all who constitute Lebanon, homemakers, housekeepers, business leaders, garbage tycoons, publishers, journalists, activists, academics, farmers, cooks, clerks, clerics, military personnel, security guards, bakers, brewers and butchers, athletes, artists, dancers, sports promoters, official tour guides, taxi drivers, delivery heroes or villains, peddlers in the most informal economy sectors, investors, lawyers and politicians all included.

FINANCE, FINANCE, AND FINANCE

Access to finance and investments is the most obvious need and most evident barrier in the path of anything requiring capital expenditure in Lebanon today.

At the bottom line, however, resistance to change and the need for new behaviors apply to all who constitute Lebanon

Due to the high initial capital expenditure for solar PV systems, the first significant tools of incentivization anywhere have been subsidies of the generated electricity and attractive loans. This was especially true before the 2010s, at a time when costs of photovoltaic panels were above $0.5 per installed kilowatt hour.

The cost has come down radically and is below 10 cents and might be scratching $0.05 in utility-scale installations[2], which also for households means amortization periods that are cut to a fraction of their previous duration.

Nonetheless, self-finance of a small solar PV unit out of savings is rare for households and up-front payment for an industry-scale or utility-scale project either impossible or financially nonsensical for these installations where professional finance and long-term power-purchase agreements (PPA) are the norm. Thus the disproportionate importance of loan finance.

In Lebanon's conservative financial environment of the 2000's with its predominance of collateralized bank lending, central-bank supported

loan instruments known as NEEREA (National Energy Efficiency and Renewable Energy Action) loans played an important role in widening the solar market from a narrow focus on solar water heaters and invigorated the nascent market for solar PV. Consequently, as these lending channels started to dry up from 2018 and then became defunct, the following period actually saw a gradual demise of demand reflected in lower PV capacity increase rates already in 2019.

The importance of subsidized lending of a productive and green variety appears to be reflected in the latest Solar PV Status Report for Lebanon[3] which, irrespective of other externalities and the subsequent severe economic disruptions, shows annual rates of increase in installed capacity varying from 139 and 151 percent in 2013 and 2014 to 43 and 38 percent in 2011 and 2019, respectively the years when the loans were new and vanishing. Seeing a fluctuation of more than 110 percentage points between the highest and lowest annual growth rates in a single decade might be read as the mark of an industry that is extremely sensitive to extraneous factors.

At solar PV company Novaenergia, the business growth of the mid to late 2010s, as at other sector companies, was indeed fluctuating. However, as managing director Joe Hawi recalls, there was overall strong business up to 2017 which in 2018 was shaken by indirect signals – but not clear messages – from the financial sector. "In 2018 we had signed a few contracts but received word that there was no financing for them. There was no clear signal, just calls asking for more time. Then the NEEREA loans were stalling. That was a bit of a shock, because as a company with an operating overhead it is not nice to hear that your projected revenue is disappearing for no reason," Hawi tells Executive.

RE players Ecosys and Phoenix Energy confirm that the liquidity crisis of 2019 brought numerous financing mechanisms to a painful halt, from NEEREA loans to private funding. "Due to the crisis, all these financing incentives stopped. This meant a major drop of solar business in the short term and it is no secret that the number of new [industrial and commercial] projects dropped tremendously between the third quarter of 2019 and the end of last year," explains George Geha, chairman and general manager of Ecosys.

According to him the demise of business in 2020 must also be partly attributed to the coronavirus crisis but the absence of financing was a key factor why expected demand for commercial projects in the past two years did not materialize, given the high capital expenditure required. While Ecosys could cover its overheads because of its earnings from projects outside of Lebanon, Geha adds he has seen too many local solar companies close down in the past two years. He is hardly cheerful about the access to finance getting better in the short term. "The biggest barrier is the Lebanese bankruptcy. No one is willing to give loans to a single bank in Lebanon until then," he says.

Besides restrictions on access to finance, financial viability questions [...] also stand in the way of new PV investment decisions

At the Phoenix Energy enterprise about 25 kilometers north of Beirut, general manager Simon Gerges likewise says that the company has in the past two years sustained itself mainly from its income generated in projects outside of Lebanon. He also sees no viability today in negotiating for foreign funding except possibly with the global community and International Financial Institutions (IFIs) on the strategic macro level. "Even for investors who are very interested in financing renewable energy, Lebanon is a high risk country that I don't think they can approach. We actually had very nice projects that foreign investors wanted to invest in. Because private PPAs are not allowed in Lebanon, we were preparing for leasing options in PPA. These approaches are stopped for the time being," Gerges tells Executive.

After he was confronted with troubling signals on the availability of loans in Lebanon in 2018, Novaenergia's Hawi has actually ventured into innova-

tive financing of solar PV together with Looop, a partner company from the solar industry in Japan. Looop is a young company with a wide range of manufacturing and operational activities in Japan and overseas, a RE venture that has five funding rounds under its belt and according to its website has a capital in the range of USD 20 million. Discussions with the Japanese corporation were according to Hawi aided by the fact that Looop wanted to diversify further and saw Lebanon as a country that has no choice but to develop RE.

The outcome was a joint venture named Looop Nova which Hawi, its managing director, describes as a "Japanese-Lebanese entity with the sole purpose of developing and financing business-to-business solar power purchase agreements in the Lebanese market." To comply with the stipulations of the Lebanese law that do not allow peer-to-peer power purchase agreements, Looop Nova engineered leasing agreements with corporate Lebanese clients, thereunder installing solar PV at the client sites of business.

This joint venture was immediately successful, which was reflected in 2019 revenue for Hawi's enterprise that was better than the revenue Novaenergia is achieving in 2021, despite the residential demand boom this year. The lesson of the venture into a new financing dimension for Hawi was unmistakable. "We really made a paradigm shift and I can tell you that once there is financing for the Lebanese market, all the noise that is happening today will be dwarfed by the market's appetite," he tells Executive.

Notwithstanding that the financial base of Looop Nova, deposited at a Lebanese bank, was massively impacted by the banking sector's infamous shutdown of access to deposits, Hawi remains upbeat about the financing road and says he is in communication with IFIs, discussing the potential for foreign RE funding.

Besides restrictions on access to finance, financial viability questions finally also stand in the way of new PV investment decisions by Lebanese industrialists, Gerges says, pointing to the price of solar versus the still low price of grid electricity. Even as diesel generator power is getting more and more expensive, tariffs for grid electricity are not yet on a clear path of adjustment and this is a barrier for an industrialist who has to decide whether to invest in renewable energy right at this difficult time.

"The uncertainty about future costs of electricity is enormous. If in one year there were to be again 12 or 14 hours of electricity [from the grid], all the calculations [about viability of investing in PV] will be ruined," Gerges says. This, however, to him does not change the Lebanese RE industry's prospects in the long run. "We all agree that renewable energy will continue to grow on the long term," he emphasizes.

In the perspective of LCEC's Achkar, there were some factors that helped in the stimulation of solar PV demand in 2020, a time when conventional power supply was still significant but growing concerns for future energy safety were on people's minds. "People had the fears of higher electricity prices and at the same time their Lebanese lira savings were losing value, so they had to invest in something that they were sure of," he lays out what he sees as the explanation why still some sizable new solar PV projects were emerging between the end of 2018, the time when support from financing mechanisms at the central bank become elusive, and the end of 2020.

Achkar acknowledges, however, that there is no real access to finance that inquirers can be directed to this year. He reveals that not only has LCEC recently been in continual contacts with IFIs but that also banks have been reaching out to LCEC in search of support: they were looking around the world for programs offering liquidity that would allow these banks to finance solar PV projects.

> "No lender will now give any loan to any [RE] project. So perhaps the government can be the first lender"

"Even banks are prioritizing investments in solar PV but they currently don't have the means to," Achkar tells Executive while indicating, similar to the vast majority of stakeholders in Lebanon's RE sector (and stakeholders in anything in this country), that his hope for recovery of access to finance for RE and the implementation of the RE transition as top item on the national agenda, rests on the new government and reforms.

Whereas the urgently needed agreement with the International Monetary Fund (IMF) thus is generally regarded as the sine qua non condition for stability-enhancing development of Lebanon that liberates access to finance and will claw back investors' trust, the urgency of making progress in the RE transition recently also appears to be expressed in outside-the-box thinking. This calls for fast-tracking finance tools of crowdfunding, use of IMF Special Drawing Rights (SDRs) and green bonds designed in collaboration with the Lebanese diaspora.

Climate proofing of development plans in Lebanon was another but less daring tool for attracting RE-focused investment into the country. At a UNDP webinar exploring climate issues and Lebanon's NDCs in October just ahead of the COP 26 summit, Jihan Seoud, manager of the UNDP Lebanon office's program on energy and environment proposed that adding climate risk mitigation measures to a broad range of projects in the development agenda such as the Lebanon Economic Vision of McKinsey could attract greater investments overall and eventually unlock billions of additional private sector investor dollars.

"No lender will now give any loan to any [RE] project. So perhaps the government can be the first lender. If it uses SDR money to lend to [RE project] developers, the government can return this money to itself two years after a wind farm or PV farm starts generating, [provided that] it has done tariff adjustments and all that. This is the only way I see. Otherwise, we have to wait for a IMF program," Harajli opined.

However, even when disregarding questions over the present value of old consulting plans, or of size and time needed for development of crowd finance channels, and legal frameworks for crowd investing, or of the conditionality of conversion of SDRs and using this debt tool (not to mention competition with other urgent social needs for using those scarce SDRs), the Godzilla issue of restoring international investor confidence cannot be assumed to solve itself in just a few months or years.

In this sense, World Bank Group regional director Saroj Kumar Jha, a participant in the UNDP webinar, threw cold water on dreams of soon mobilizing new green finance for Lebanon: "Trust me, no investor is coming to this country until you take a large number of macro fiscal stabilization measures. The country is not conducive to any investor. Why would they come here?"

As part of what he called his reality check on the situation, he emphasized that integration of climate change action in people's agendas cannot be achieved by NDC updates, airy climate goals, policy notes, academic papers (or, unmentioned by Jha, economic magazine stories). In a country characterized by divergence of people and state, where there is no trust in the government or institutions, a national dialog with the people on climate issues and internalization of climate action into the people's economic aspirations are more pertinent, he suggested, adding: "Our thinking has to be absolutely unconventional and very uniquely tailored to the Lebanese situation."

Stating a view that it will be very painful and take many years to stabilize the financial sector and move to growth, Jha nevertheless pointed to opportunities for Lebanon such as working with partner sovereigns who team up with investors for creation of exclaves where green investments would be completely ring-fenced and fully de-risked. Another idea would be to tap into diaspora expertise and means by setting up a diaspora green bond in a tripartite compact between the government, the diaspora, and a qualified financial advisor as facilitator. But as first order of importance for a viable climate agenda in Lennon, Jha opined that the agenda must become the people's agenda, that the people make climate their aspiration, and change their behaviors.

RESISTANCE TO CHANGE

Resistance to change is known to business organizations as risk and often experienced as highly detrimental by any entrepreneur and any team leader in any industry and third sector endeavor. It is a fact of life and its impacts on economic activities are feared by executives, ironically even by those decision makers that work in corporations and industries which themselves are very strongly resisting change, for example by shifting away from relying on coal for electricity generation.

Integration of climate change action in people's agendas cannot be achieved by NDC updates, airy climate goals, policy notes, academic papers

It can't surprise that resistance to change is a feature of politics. News from any government in Lebanon – whether active, tired and about to resign, caretaker, or brand new – contains elements of a lesson on resistance to change and that behavior's detriments and opportunity costs.

Not accepting evident need for reform and insisting on "business as usual" has during at least the last ten, formed or even attempted, cabinets in Beirut meant that no effort was spared in not shaking the status quo and seeking change. Privileges, self-interests, and clienteles, none of which is appearing to be an endangered species in Lebanon, were defended with the same ardor as the most aggressive environmentalist might guard the habitat of the last living sea turtle.

As first order of importance for a viable climate agenda in Lebanon [...] the agenda must become the people's agenda [they must] make climate their aspiration, and change their behaviors

Knowledge of this past political trajectory, which meant that many important law drafts have fallen by the wayside, is not supportive of trust that the key laws for RE enablement will pass smoothly. Nor can it be assumed that the urgency, of the people's increasingly desperate needs for safe, affordable, and sustainable energy from renewable sources such as wind, solar, and water, will ever be strong enough to overcome the resistance to change in the Lebanese political establishment.

It is by the way no comfort but a highly worrying fact that Lebanese political actors are no outliers when it comes to long-standing resistance to necessary change. This global truth is at time of this writing being cemented as a further brick in the wall of climate degradation, with the COP 26 summit in Glasgow witnessing a continuation of resistance to change that was similarly observed in the contexts of the Kyoto Protocol's adoption in 1997, the Copenhagen Climate Summit of 2009, and the 2015 COP 21 Summit that led to the Paris Agenda. One can further dig into the past to the UN's 1992 Rio Earth Summit with its signing of the Framework Convention on Climate Change (UNFCC) and the 1972 "Club of Rome" shock message on the Limits of Growth and the perils of humanity's "business as usual" path of industrial economic behavior. If one is so inclined, one might even find resistance to change evidence in every age tracing back through the industrial and pre-industrial past.

Back in the present, even as it has become clearer and more compelling with every decade over the last 50 years that it is in the long-term best interest of large and small corporations and large and small nations alike to mitigate and remove climate risks, self-interests and irrational resistance to change, what the world has so far gleaned from climate summits has been hot air and perhaps a location list for a better James Bond movie.

BEHAVIOR CHANGE

Behavior change born out of increased climate awareness and acceptance of responsibility for our world has two RE dimensions, one of energy preservation and one of building up renewable energy sources. And it seems to begin not just with awareness but with shocked awareness. "You cannot believe with what inefficiencies we Lebanese people across all sectors have been living. We have been living fat lives where each house has two or three cars and people keep three air-conditioners turned on at night. The crisis today is shaking the roots out of this system," exclaims the usually stoic Harajli almost emotionally at one point in his conversation with Executive.

And there is immense room for improving both production of RE from solar and wind (see above) and also room for better energy efficiency in Lebanon – and apparently some increasing awareness and budding new behaviors (see stories on mobility page 43, composting page 53, and waste avoidance page 64).

However, efficiency moves and behavior change are in order not only on the level of the too

many Lebanese households that run AC units on wasteful and unhealthy settings and own upward of three cars, at least one of them a gas-guzzling SUV or muscle car. These private fancies are symbols of wasteful practices in industry and economic activities that exists in all political sects and among adherents to the various communities in Lebanon.

Bassem Taki, a veteran engineer with 21 years of concentration on RE and energy efficiency tells Executive of commercial and industrial projects, including major retail sites, where reductions of up to 50 percent of electricity consumption were achieved by his team. It is a very important question how far electricity consumption could be lowered by better energy management but there is no standard answer because of power systems' many components from generation to end users, he says.

However, the most important component to the entire electricity net at this moment in the 21st century is the human mind. It is the mindset. As Taki tells the energy story, energy conservation gains are perfectly feasible in technical and economic terms but for the improvement of the energy safety it is necessary to increase awareness and knowledge on photovoltaic and other RE alongside with instruction on efficiency. Even to reduce a small load in electricity systems, changing user mentalities is needed through education and lectures, plus concrete incentives.

"I find that around 20 to 25 percent of persons who attend my lectures [on methods for improving energy efficiency] will say, 'yes, you are right'. But how many people will apply the lectures? Less than 20 percent of those who say yes. My opinion is that if you set a rule [of incentives] that give people a concrete benefit and then tell them, 'do this and stop doing that', you can convince people to do it," Taki explains.

Taki maintains that a mentality change towards energy savings in Lebanon has to be induced from many points. "Energy saving starts with the knowledge and mentality of the people. Starting from the university, from the church, the mosque, all people should talk about this," he advocates.

But changes can start with small responses to large threats such as the collapse of livelihoods and energy safety in the entire nation. There are grassroots efforts going on in Lebanon as the global leaders speak in Glasgow (and before and after). Studies on energy efficiency enhancement potentials in small businesses and enterprises have shown that half of 86 sampled SMEs are in urgent need of improving their energy efficiency, says Walid Baba, president of the Lebanese Solar Energy Society (LSES). In an ongoing pilot project for the development of Energy Services Companies (ESCOs) as contributors to clean energy transition, LSES is collaborating with a European non-profit on the creation of a net of ESCOs that will endeavor to implement energy audits and efficiency projects with client SMEs, ESCOs thus acting as multipliers of energy awareness, RE usage, and energy efficiency at SME level. "The [energy] crisis exists and is very dangerous. But let's think positively. We have to build the pyramid from down to up. Today LSES is trying to participate in the building of this slab [at the bottom of the pyramid]," Baba says.

Even to reduce a small load in electricity systems, changing user mentalities is needed through education and lectures, plus concrete incentives

Where does this litany of depressing and inspiring signals leave the country? Macro-financial stability and easy access to finance is a long way off, even as Lebanon hopefully is about to undertake the first negotiation step on a long journey of rebuilding its international financial credibility. Resistance to change we will not ever get rid of, not in ourselves, not in our economic entities, in our activist community, or in any global or local political context.

In historic lessons of behavior change, it has been catastrophes, fires, pestilence, wars, and earthquakes that have at least sometimes led to behavior changes of a measurable duration and intensity. The best news then, ironically: Energy behavior change is now a survival issue in Lebanon. A global target or a policy paper or even the best designed public sector campaign will not suddenly translate into energy safety. A plethora of small practical improvements, mentality checks and individuated mindset changes are the solutions on tab. They can be used and expanded.

1. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jun/IRENA_Outlook_Lebanon_2020.pdf
2. For a graph showing the downward trajectory of solar PV costs in the 2010s, see Irena graphic https://www.irena.org/Statistics/View-Data-by-Topic/Costs/Solar-Costs
3. https://lcec.org.lb/sites/default/files/2021-04/LCEC1.pdf

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By Marc Ayoub

BREAKING BAD POWER MANAGEMENT

The political economy of the energy transition in Lebanon

Amid the worst economic crisis Lebanon is witnessing since the civil war, one could identify two major observations (a positive and a negative one) when it comes to the country's energy sector, which is considered both a main cause and a major contributor to the financial gap the government is currently facing. The negative one is that Lebanon appeared to be a country running on diesel, across all its vital sectors such as health, telecommunications, transportation and of course electricity (through the private diesel generators). The other, positive observation is that the current crisis has allowed to create a collective awareness among citizens and communities around the importance of renewable energies, and mainly solar energy, as a tool to reduce their reliance on diesel, along with its long-term environmental and health benefits.

Yet, the current almost-complete blackout the Lebanese people are living is not a surprise nor a coincidence, but rather an expected result of the decades-long mismanagement of the sector. Lebanon's power and energy sectors' struggles are the result of the fundamental policy inaction that reigns over decades, with under-investment in infrastructure since the late 90's, a lack of a comprehensive vision of the country's energy mix, and a deliberate negligence of the potential of renewables energies.

FUEL IMPORTS: A HIGH DEPENDENCE ON FOSSIL FUEL

The MENA region has always been characterized by a high dependence on oil and natural gas to meet its energy needs. Although the region is a major energy producer, many countries are struggling to meet growing domestic energy demand. According to BP numbers in 2019, the Middle East is expected to face an annual increase in energy demand of around 2 percent until 2040, where the power, transport, industrial, and non-combusted sectors will mainly be responsible for this high increase in final energy consumption. Therefore, transitioning to energy systems that are based on renewable energy is a promising way to meet this growing demand, and has started to be implemented in several countries of the region.

Being part of this region, but not as an energy producer, Lebanon has been a major oil importing country for decades, making it economically vulnerable to oil price fluctuations, a matter that severely endangered its prosperity, and has recently caused a severe jump in gasoline and diesel prices completed with a total removal of subsidies. For years, imported fuels accounted for around 97 - 98 percent of the energy supply putting a huge burden on the state's budget. The electricity generation sector was, and still is entirely dependent on imported petroleum products, which we lack the foreign currencies to currently buy. In addition, the transport sector is heavily relying on gasoline and diesel, with the absence of a stringent and sustainable transportation sector.

Lebanon's total primary energy supply in 2018 was 8.57 Mtoe, or around 61.21 million barrels of oil according to the International Energy Agency (IEA) in 2020. In terms of the energy consumption by sector, the transport sector dominates accounting for 52 percent, followed by the residential sector (19 percent), and the industrial sector (14 percent) as shown in the figure on page 33. The energy mix is predominantly made up of oil. In 2018, oil held a 95 percent share in the energy mix, coal accounted for 2 percent (mainly used by cement factories), while renewable energies held a share of the remaining 3 percent, including hydropower.

Oil sources in the energy supply have always been the key fuel in the energy mix, varying between 92 and 95 percent since 1990.

However, the Lebanese energy strategy is today at a turning point, as the country cannot continue relying on imported fossil fuels that are bought via the dwindling foreign currencies reserves at BDL. The latter has started the process of subsidy removal on oil products earlier this summer, leaving citizens to confront the reality and burden of increasing prices without any social safety net.

According to the Directorate General of Oil (DGO) numbers in 2018, the imported fuel products in the country amount for around 8.5 million tons combining liquefied petroleum products (propane and butane), gasoline (98 and 95), diesel oil, heavy fuel oil, jet fuel, asphalts and petroleum coke. This would account for around $6.2 billion of hard currency, $1.7 billion of which was used as fuel subsidy for Electricité Du Liban (EDL), Lebanon's national electricity utility, while $2.4 billion were used for gasoline products.

These numbers fell in 2020 during the COVID-19 pandemic, where fuel imports amounted to only around $3 billion, equivalent to 7.7 million tons of products.

LEBANON'S DOWNSTREAM OIL CARTEL IN NUMBERS

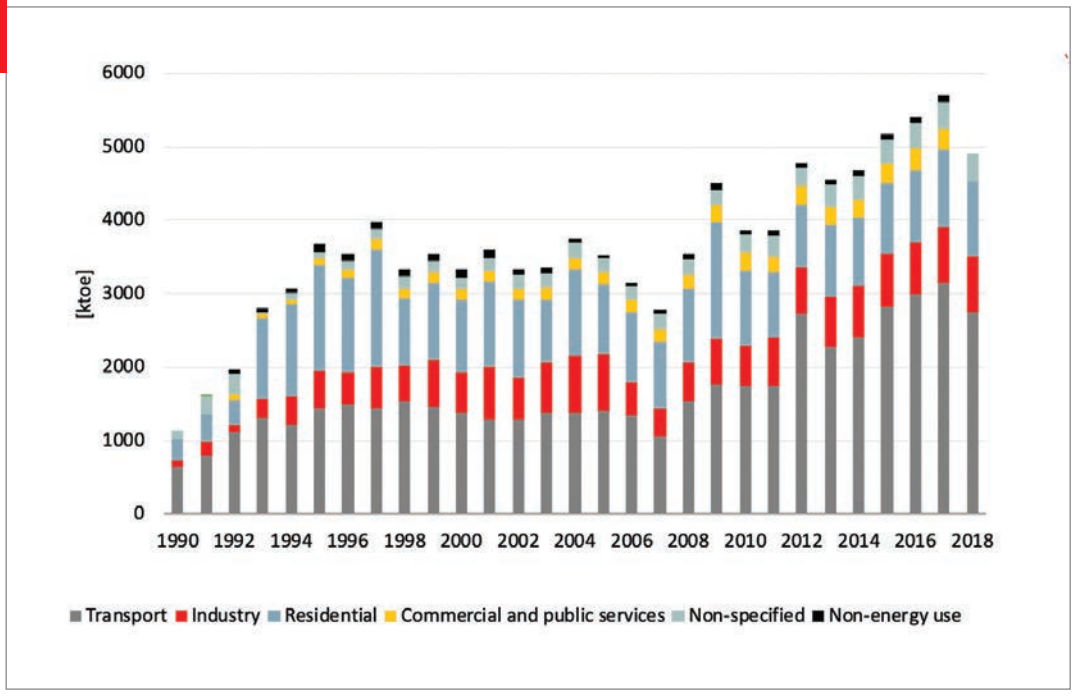
The downstream oil operations, by definition, cover the import, storage, marketing, distribution and use of hydrocarbons as well as related infrastructure that is used to supply oil products to the national market.

> Lebanon has been a major oil importing country for decades, making it vulnerable to oil price fluctuations

The downstream oil sector in Lebanon is controlled by 13 private companies that import, store and distribute the majority of the fuel products, benefiting from a large storage capacity. The latter allow these importers to manage more than half (or 55 percent) of the distribution stations that amount in total to around 3,100 stations. They also own around 68 percent of the distribution trucks that transport oil products to the several regions. The sector has been governed by the decree 5509/1994[1] that organizes the several activities across the value chain from import, to storage, transport, and distribution. To date, this decree has never been well implemented or followed.

When adding to those 13 companies the ones working in the gas sector as well as in the cement

TOTAL FINAL ENERGY CONSUMPTION (IN KTOE) , LEBANON 1990-2018



Source: (IEA, 2020)

industry, which both import their own share of oil products, the total number of companies becomes around 18, equivalent to the number of companies operating in France, and way above the ones in Jordan (5 companies) and Syria (15 companies). This large amount of actors for a small market like the Lebanese one makes their alliance and cooperation vital to secure the profit share. Consequently, these companies do not import individually, but rather agglomerate to import the same shipments and then share the quantities to distribute them in the market, reflecting a clear representation of the monopolistic structure of the sector.

The majority of these companies have emerged during the civil war years with the collapse of the country's institutions. This cleared the way for militias and influential people to evade government controls and started importing from Syria and other countries, benefiting from their control over the coastal cities and its reservoirs. After the end of the war, more autonomy was given to the private sector as of the 2000's, and these companies expanded.

These 13 companies have a powerful storage capacity, with 7 terminals on the coastline to store petroleum products shared by both private and public sectors. While those imported from the Government are concentrated at the oil installations in Tripoli and Zahrani, the private sector reservoirs, which accommodate quantities touching 500 million m3 (excluding jet fuel), are distributed over seven ports in Dora, Antelias, Amchit, Zouk and Anfeh, Tripoli and Jiyeh.[2] As for the facilities in Tripoli and Zahrani, they contain about 481,000 m3 in the tanks currently in use.

AN INCREASING DEMAND FOR SOLAR-POWERED SYSTEMS

Building on the positive observation the crisis has emerged with when it comes to the importance of renewable energies, the Issam Fares Institute at the American University of Beirut has launched a quick survey in August 2021 with companies working in the implementation of solar projects for households, industrial and commercial activities, in order to assess the increasing level of demand on those solar systems. 20 companies have responded to the survey and the answers have shown that between January and July 2021, those companies have received around 6,700 requests to install solar systems, 516 of which have effectively seen light with a total energy generated of around 7.75 MW. This means that when citizens get to know the real cost

of installing such systems, they become reluctant in moving forward, and also that the year 2021 is expected to reflect the most important increase in solar systems' installations during the past decade.

By end of 2019, the installed capacity of renewables was around 365 MW, including 286 MW of hydropower and a cumulative PV installed capacity of 78.65 MW, according to the Lebanese Center for Energy Conservation's 2019 solar status report, while the Lebanese Government has announced its aim to reach 30 percent of Renewable Energy by 2030. In June 2020, the latter target was further supported by International Renewable Energy Assocaition (IRENA)Outlook for Lebanon stating that for Lebanon to reach 30 percent, it was to install around 4,700 MW of solar, wind, hydropower and biogas.

> The energy transition will need to leave no one behind, and innovative political economy tools would allow all social constitutents to take part in it

A POLITICAL ECONOMY CONSTRAINT TO THE ENERGY TRANSITION

Lebanon's electricity sector is affected by three key challenges that impact the energy transition at least in the short-term, but potentially also in the long-term: weak governance, underinvestment in the supply, and the lack of financial stability. Deep-rooted political economy challenges have heavily weighed on the energy and electricity demand and supply over the past years. Electricity reform efforts do exist mainly on paper without being implemented, and the main question remains: why hasn't it?

A successful transition to a more open and competitive power market that supports the renewable take-off will further depend on appropriate institutions and structures with clear roles and responsibilities, as well as a robust regulatory framework. A transition towards a more resilient energy system further requires first the diversification of energy supply and energy demand management on the technical side, but also tackling the political economy constraints that would allow the leapfrog towards renewables, namely the oil cartel value chain, and the diesel generators' market and network, both benefiting from the collapse of the electricity and energy sectors.

The energy transition will need to leave no one behind, and innovative political economy tools would allow all social constituencies to take part of it, where a just participation in the energy transition involves citizens' awareness. Furthermore, the introduction of participatory tools and channels in the energy transformation process could foster acceptance and contribute to fair power dynamics and energy policies.

Both policymakers and citizens need to understand the benefits that renewables can offer and recognize how global cost reductions make this technology an interesting alternative to fossil fuels imports as well as diesel power generation. In fact, the cost of solar panels has dropped by 85 percent over the last 10 years.[3]

The old system of dealing with electricity issues has led to the current complete collapse. A way out should consider renewable energies as a centerpiece of energy planning and not just a policy add-on. This cannot be done without a comprehensive system that ensures the proper implementation of renewable energy systems and the removal of existing legal, institutional and political economic hurdles in front of this implementation.

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[1] Available on this link
[2] According to the 2017 Oil and Gas Handbook by Lebanon Opportunities
[3] According to IRENA 2020 Renewable Power Generation Costs available on: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Jun/IRENA_Power_Generation_Costs_2020.pdf

By Christina Abi Haidar

INCENTIVIZE TO ENERGIZE

Making inroads into private sector distributed renewable energy generation

Through its Nationally Determined Contribution (NDC), approved by Parliament under Law 115 dated 2019, Lebanon has committed to achieving a 30 percent reduction in greenhouse gas emissions by 2030. Moreover, the policy paper for the electricity sector issued by the Ministry of Energy and Water (MoEW) and approved by the Council of Ministers on April 8, 2019, aims to secure 30 percent of Lebanon's total electricity consumption from renewable energy (RE) sources by 2030. Achieving these lofty goals seems very unlikely, the private sector is incentivized to participate in the generation of such energy.

The electricity sector already had to grapple with a difficult financial situation and the high costs of maintaining its production and distribution networks, so it was among the first services to suffer from the collapse of the economy alongside the banking sector. In turn, it directly affected a host of other sectors that rely on electricity, from industry to agriculture, hospitality, media, and banking again. Lebanon's crippling energy crisis is made worse by its dependency on fuel imports which are threatened by the shortage of US dollar currency. Rolling blackouts that for many years used to last for three to six hours per day, as of May of this year would leave entire areas with no more than two hours of state power a day. The Lebanese increasingly depend on private generator operators that also struggle to secure supplies amid the crash of the national currency and removal of subsidies.

The electricity sector breakdown can be attributed to a number of reasons, including a series of seemingly deliberate attempts at weakening the state utility Electricité du Liban (EDL) through apparent mismanagement and corruption. Decree 16878 dated 1964 conferred both administrative and financial autonomy to EDL, giving the public establishment monopoly over the electricity sector by being solely responsible for the generation, transmission, and distribution of electrical energy in Lebanon. This autonomy has been challenged and undermined by political actors since the end of the civil war, weakening the public institution

and establishing full dominance by the MoEW, the tutelage authority presiding over it, in addition to delaying key reforms for its rehabilitation.

EDL's situation already had worsened with the August 4 Beirut Port explosion that destroyed its headquarters' administrative assets, meter laboratory, vehicles and warehouses, National Control Center, distribution substations, distribution lines, a data center for the billing system, and other assets, estimated at between $40 and $50 million. Only a few substations within the blast radius received minor repairs, but no clear plan has been put forward to rebuild its headquarters or replace infrastructure assets and equipment, all of which require high expenditure that is not currently available, nor has it been for years.

As a result of all the above, power supply has deteriorated to critically low levels and fails to meet national needs. Rural areas are particularly impacted by the lack of access to electricity. EDL has become operationally bankrupt and constitutes a drain on the government's fiscal resources. This has also affected other power utilities that purchase electricity from EDL, including Electricité de Zahle. In addition to the fact that billing collection is mismanaged, tariffs are too low to cover power generation and delivery costs and the number of defaults on payments or cancelled subscriptions is increasing as fewer households and businesses can still afford even these low tariffs. Power is also widely stolen, compounding the utility's losses. Finally, Lebanon is among the very few countries that still rely on heavy fuel for power generation, a material that is environmentally unfriendly and carries serious implications for the health of the population due to its high level of emissions that exceed globally accepted standards.

■ The centralized nature of the electricity sector, along with all the problems it suffers from, has become an obstacle to its reform and [...] to allowing investments in RE generation

FAILURE TO RESOLVE THE MONOPOLY

The centralized nature of the electricity sector, along with all the problems it suffers from, has become an obstacle to its reform and, most importantly, to allowing investments in RE generation. While privately-owned generators so far continue to ration electricity to households and businesses, their dependence on fossil fuel casts doubts about their ability to maintain operations, or retain a base of subscribers able to afford their fees.

The conversation is logically shifting towards renewables, although it is not a new idea in Lebanon by any means. In 2010, 6.1 percent of Lebanon's electricity generation relied on hydroelectricity through concessions awarded as far back as the French mandate. RE power is generally considered a reliable clean source of electricity with significant economic, environmental, and social benefits to Lebanon's economy: a) It reduces our reliance and/or dependence on fuel imports; b) it assists in the balancing of our national budget through the reduction of fuel import expenditures; c) it creates more employment opportunities as renewable energy is able to offer more local employment opportunities per unit size installed when compared to conventional power sources; and d) it improves the health of Lebanese citizens and the resilience of Lebanese natural ecosystems from reduced air pollution and the reduction of greenhouse gas emissions.

The failure to ensure a reliable supply of electricity has led the Lebanese people to resort to alternative individual solutions as they are legally eligible to use renewable energy resources for their own consumption (see Overview page 12). The existing legal framework encourages this mainly through Article 4 of Decree 16878 that allows producing RE power "for their own consumption and to cover their personal needs only." Also tapping into Article 4, an Administrative Curriculum (memorandum), based on a Decision of EDL's BoD (No. 318-32/2011, titled "net metering"), approved a mechanism whereby consumers can inject sur-

plus RE power generated on their premises (and for the primary objectives of fulfilling their own needs for power) into EDL's grid and be credited, in return, against their consumption of power from EDL. The net-metering mechanism is certified by the MoEW (as the tutelage authority over EDL) and approved by the Ministry of Finance (MoF) (since it has a financial deduction effect) on an annual basis. The approval is subject to annual renewal by both ministries. Moreover Article 26 of the "Regulation of the Electricity Sector" Law No. 462 dated 2002 states that the production intended for private use with power less than 1.5 MW shall not be subject to the authorization.

One of several failed attempts by the Government of Lebanon to restructure the electricity sector and improve its performance on all levels, began with the ratification of Law No. 462/2002. This law aims to establish the Electricity Regulatory Authority (ERA), restructure the electricity sector, and unbundle the energy activities that are currently monopolized by EDL through private sector participation in the distribution and generation. To date, the implementation of Law No. 462/2002 remains elusive, mainly when it comes to the appointment of the ERA, a crucial step to pave the way for private sector involvement. Since 2012, the MoEW, in charge of implementing the law, has proposed amending it to limit the ERA's independence and maintain control over it.

Because of continuing political interference, several other attempts at involving the private sector in producing electricity from RE sources also met with failure. These projects were categorized as private-public, achieving legal coverage directly through the Council of Ministers (read "political favors") instead of through an independent regulatory body supposed to oversee technical feasibility and competence. Only a single RE project, consisting of a wind farm (see Salah M. Tabbara's article page 48), was planned through this private-public model, but it never kicked off due to several reasons, chief among which was the issuance of the licenses in 2017 before bankability acquisition. If the ERA had been in place then, no licenses would have been issued unless a competitive portfolio tender, part of the due diligence of the bankability assessment, had been completed. The worsening economic crisis further put an end to any possibility of making progress on this project.

LAYING DOWN THE DRAFT LAW

Since there is a lack of a clear legal framework that can provide certainty and incentivize the private sector to invest in RE power, it is necessary to establish a general law that gives all Lebanese economic sectors the opportunity to at least partially reduce their demand on the national power grid, paving the way for further penetration of distributed renewable energy systems equal to or less than 10 MWp.

> The MoEW [...] has proposed amending Law No. 462/2002] to limit the ERA's independence and maintain control over it

With the technical, legal and financial support of the European Bank for Reconstruction and Development, the Distributed Renewable Energy (DRE) law was drafted, closely involving the MoEW, EDL, and the Lebanese Center for Energy Conservation (LCEC). A steering committee was established in that regard and included representatives from all the mentioned stakeholders. After two years of work and close follow up, the draft law

was sent at the end of October 2021 by EDL to the MoEW in order to be circulated to the Parliament through the Council of Ministers.

The DRE draft law complements Law No. 462/2002, covering all technical aspects of distributed renewable energy generation while ensuring no overlapping. It allows and regulates the net-metering process in all its forms and formats in a more permanent way. As per EDL Board Decision No. 318-32/2011, only single owner net-metering (one owner, one meter) is currently allowed and is subject to annual renewal. The DRE draft law would also allow meter aggregation for single or multiple owners of multiple meters, even in geographically disconnected areas.

The draft law also allows peer-to-peer distributed RE trading through direct power purchase agreements (PPAs) for up to 10 MW. Through "on-site" direct PPAs, customers can purchase power directly from RE generators who, in turn, can divert excess electricity into the grid through the net metering arrangement. The principle is the same for "off-site" direct PPAs, with the added difference that remotely located generators will need to pay the utility for using its transmission and distribution network through which they would deliver RE power to their subscribing customers.

> Increasing electricity generation fom RE sources cannot fully replace fossil fuel power generation, but is a vital backup for the electricity sector, especially now

The law also makes provisions for the creation of a renewable energy department at EDL, until the ultimate goal of establishing the ERA.

Realistically, increasing electricity generation from RE sources cannot fully replace fossil fuel power generation, but it is a vital backup for the electricity sector, especially now. Individual RE systems are a positive trend but implementing community solutions would constitute a more solid base from which to answer Lebanon's energy needs. Ratifying the DRE at the soonest would incentivize private sector involvement in not only the generation, but also the distribution of electricity from RE sources. The private sector would then shoulder some of the financial and logistic burdens of the national grid, namely when it comes to underserved or remote areas. This would help begin to put an end to blackouts and would also generate revenue for EDL, paving the way to important and much-needed reform, staring with the establishment of the ERA. The combination of all these factors would give a serious boon to Lebanon's efforts to reach its national RE commitments, not to mention it would greatly improve overall quality of life in terms of service provision and health by reducing emissions.

Christina Abi Haidar is an attorney at law - governance and energy legal expert, and a legal consultant on the draft Distributed Renewable Energy law

Comment

By Carol Ayat

In collaboration with
KONRAD ADENAUER STIFTUNG

LIGHTS ON

Bridging the banking crisis to implement electricity reform in Lebanon

Today, the electricity sector is in full collapse and Lebanese people are plunged in darkness, with only 1-3 hours of state electricity per day. They have to rely on expensive and highly polluting private generators to provide their needs in electricity at exorbitant costs averaging $0.40/kWh. In addition, imports of diesel and heavy fuel oil (HFO) necessary to generate this electricity are estimated to average $3 billion per annum, which are being funded through the dwindling reserves of the central bank of Lebanon, Banque du Liban. Since the start of the crisis, $18 billion are estimated to have been spent from BDL reserves on imports, out of which, $6 billion on electricity related imports. Today, the remaining reserves are estimated at $13 billion.

The status quo is no longer viable. Breaking the vicious cycle requires the implementation of a comprehensive solution that is consistent with the political economic reality. One of the main impediments to implement the needed solution is the availability of funding. The state has limited ability to obtain new financing without multiple pre-requisite laws, programs, and reforms, which would certainly involve long delays. Meanwhile there is currently no appetite for private investment.

A ROADMAP FOR ELECTRICITY

In October 2021, in coordination with the Issam Fares Institute at the American university of Beirut (AUB) and multiple experts in energy and finance, I proposed a comprehensive solution to the electricity crisis across the generation, transmission, and distribution of electricity with 100 percent local funding, by bridging the banking crisis for an electricity solution. This would result in 24/7 electricity supply, allow scaling up renewables, reduce losses and theft of electricity, save $2 billion of direct costs on the annual electricity bill, relaunch economic growth and reduce the budget and balance of payment deficits.

The proposal provides the necessary prerequisites for the transition towards renewable energy. The goal of any electricity reform should be maximizing renewable energy, as it offers the cheapest, cleanest and most secure electricity source. However, the scale-up of renewables faces major obstacles in Lebanon. The technical ones being the status of the grid and the lack of base load power. Base load power is the minimum amount of electricity that should be constantly provided to the grid to manage the intermittency of renewable energy. One of the most efficient and cleanest types of base load power are gas-fired combined cycle power plants. Natural gas is considered an integral part of the energy transition and complementary to renewable energy, as it is the greenest of the fossil fuels with significant reduction in emissions when compared to HFO or Diesel, it is also cheaper.

Therefore, the proposal includes the construction of new gas-powered plants in Zahrani and Deir Ammar with a capacity of up to 2,000 megawatts, and a natural gas import facility in Zahrani (taking into effect the procurement of natural gas to Deir Ammar from Egypt), the upgrade of the grid infrastructure including the roll-out of smart meters, tariff reform with prepaid cards and a new distribution model based on decentralized distribution companies who manage the billing, collection, and sale of prepaid cards. The total needed financing is estimated at $2 billion: $1.6 billion for the generation and gas infrastructure, and $400 million for the grid infrastructure.

The funding for the generation is proposed to be sourced via crowdfunding from depositors in

■ Natural gas is considered an integral part of the energy transition and complementary to renewable energy, as it is the greenest of fossil fuels with significant reduction in emissions

local commercial banks, who are offered to subscribe on a voluntary basis to the equity capital of two new Lebanese generation companies, Zahrani II SAL and Deir Ammar II SAL, with local dollars. Investment restrictions apply such as a cap on the investment amount, subscription needs to be pro rata between the two companies and no politically exposed persons "PEP", banks shareholders or executive management are allowed to subscribe.

The management of the company will be contracted to a tier one international developer, who will manage the procurement of the Engineering Procurement and Construction (EPC) contract, while the operation and management contract of the plants will be with a globally renowned equipment manufacturer like Ansaldo, GE, Mitsubishi or Siemens.

Over the project life, depositors are expected to recoup $7 billion in fresh dollars with quarterly cash flow via the sale of electricity to the electricity utility Electricité du Liban (EDL) according to a 20-year power purchase agreement guaranteed by the Lebanese government and with political risk guarantee from a multilateral agency. The cost of electricity to EDL is estimated to drop to around $0.09/kwh (compared to current cost of generation that approximates $0.15/kwh). All the project agreements will be structured to be bankable as per international standards to allow for the leveraging or sale of the companies to international developers once macro-economic stabilization is achieved. The newly raised funds could be used to invest in renewable energy projects or as an early exit to depositors.

The electricity distribution model to consumers is proposed to be handled by localized distribution companies who take on the role of selling electricity to consumers with pre-paid cards to reduce losses linked to theft and uncollected bills. Those companies could hire some of the workforce of EDL and private generators. All revenues are deposited in an account pledged in favor of the generation companies to ensure funds are directly channeled to service the companies owned by depositors, The consumer would benefit from a significant reduction in their electricity bill from the current unsubsidized private generators rates (that are fully indexed to fuel and LBP/USD rate) currently between $0.4/kwh and $0.15/kwh.

The project should be coupled with an International Monetary Fund program to achieve macroeconomic stabilization and eliminate multiple currencies, however it can be launched imminently following the passing of a project-specific law, complementary with Law No. 462/2002.

The proposal has been designed to force the required sector reforms at the project level. It is a bridge towards the decarbonization of the Lebanese electricity sector and is resilient to external shocks. It aims at resolving multiple problems at once (including resolving the electricity crisis, enabling the scale-up of renewables, allowing economic recovery by reducing the cost of electricity, reducing the balance of payments and budget deficits) and presents a growth-story partial and voluntary solution to local depositors.

Every single day delayed in implementation has direct financial costs to the Lebanese economy estimated at $5.5 million, not to mention the environmental and opportunity costs on the economy. If successful, the funding model can also be applied to renewable energy projects and to various sectors such as transport, waste, water, ports etc. With political leadership and popular willpower, Lebanon can emerge from this crisis stronger, more resilient, and with a healthier economic model.

To know more about this project, which was published by the Issam Fares institute for Public Policy and International Affairs at the American University of Beirut, you can download it from the following link: https://www.aub.edu.lb/ifi/news/Pages/20211020-comprehensive-solution-to-the-lebanese-electricity-sector-report-launch.aspx

Carol Ayat is an energy finance professional and investment banker, and a senior fellow at the AUB Issam Fares Institute

By Alexis Baghdadi

RIGHTING A WRONG TURN

The revalorization of informal transportation and mobility rights

Stranded near a busy intersection in Beirut, this writer waited thirty minutes to get a cab back to Executive's offices, located only 3 kilometers away. In that time, traffic revealed a noticeable drop in the amount of single-occupant passenger cars and available taxis and "service' cabs, compared to pedestrians, cyclists, goods and passenger vans. Yes, walking would have been faster and cheaper, but I was not dressed for the heat and humidity.

Under the current circumstances, the increasing re-appropriation of roads by adepts of public, shared, and informal commuting can only be expected to last or become further accentuated, and it will hopefully translate into a number of benefits on the long-term. Looking beyond the traditional promises of reduced emissions, economies of time and money, improved health, etc., a supported informal mobility system could lay the foundation for reevaluating the transport sector along more sustainable lines and even reinforce the fabric of society. These paradigms are still very largely absent from the discourse of mainstream media and pundits.

To regurgitate the latest problems plaguing the transport sector as a result of the economic and fuel crises would be overkill at this point. Media outlets have done a fantastic job of gratuitously covering the issue through a thick lens of yellow journalism. They have made sure to heavily season their "reports" with commentaries from the most colorful, most photogenic, and most exasperated car owners. They also sped to share any footage of altercations at gas stations in obsequious attempts at luring in viewers to increase advertising revenues.

THE ELUSIVE GREAT DEAL

Lebanese car dealers are reeling from the effects of drastically reduced sales over the past two years. Car sales in Lebanon dropped by 37.2 percent during the first nine months of 2021, compared to the corresponding period in 2020, and by 83.7 percent compared to the same period in 2019, according to a statement released by the Association of Automobile Importers (AIA). In recent interviews, Salim Saad, advisor to the AIA, mentioned that Lebanese car dealers had only sold 6,152 vehicles in 2020,

compared to 21,991 in 2019 and 33,012 in 2018.

In light of the current fuel crisis, the knee-jerk reaction of some car owners and would-be owners, has been to consider less fuel-hungry vehicles like hybrid and electric cars. At first reading, this could present attractive advantages in terms of both reduced emissions and national fuel imports bill (see Marc Ayoub's article page 32). But is it likely that enough car owners can make this transition to ensure a positive impact? A recent Economic Digest by Blominvest Bank sees a rebound in car sales as highly unlikely since Lebanese consumers are seeing their purchasing power continue to shrink and are prioritizing spending on essential goods.

The relatively high cost of new hybrid or electric cars, together with the limited availability of hard currencies, constitute the main barriers to acquisition. Banks have stopped issuing car loans to customers, leaving hopeful buyers with only the options of cash payments or trade-ins. Assuming car owners wish to sell their fuel-hungry vehicle to secure the coveted US dollars necessary to purchase a more economic car, they would be hard-pressed to find local buyers. Any potential buyers would be equally wary of the high prices of gasoline, and would also be reluctant to part with their cash US dollar banknotes.

Finding a sustainable source of electricity (ergo, one that does not rely on fossil fuels) to power electric vehicles would require setting up a new generation and supply infrastructure, probably relying on solar energy. Achieving this would require major reforms in the power sector, as-of-yet a very distant eventuality. Lebanon's goal to generate 12 percent of its electricity from renewable sources by 2020 has fallen abysmally below expectations, casting further (justified) doubts on a revised goal of 30 percent by 2030 (see Christina Abi Haidar's article page 36). At the time of writing this article, the supply of power from the national grid, mainly generated from fossil fuels, is limited to 1 or 2 hours per day, with private generators rationing out electricity to households – those that can still afford the rising monthly fees, naturally.

On this note, in April this year the first "Made in Lebanon" electric car was unveiled by EV Electra, a division of Jihad Mohammad Investment owned by Lebanese-born Palestinian businessman Jihad Mohammad. Locally manufactured – or assembled? The issue is not clear and EV Electra did not respond to Executive's request for comments – the Quds Rise sports car is the first in a range of 10,000 electric vehicles the company announced it hoped to manufacture by 2022. The car's supposed green impact is somehow insignificant in a country reliant on fossil fuels for electricity. In previous statements to the media, Mohammad had mentioned setting up solar- and wind-powered recharging stations for the company's cars in Lebanon. Given the rapid developments in the country over the past six months, time will tell if these vehicles find a ready local market (with payment facilities for local buyers promised by the company owner) or if they will be limited to export markets only, provided it is still viable to maintain manufacturing operations in Lebanon.

CAN WE RUN ON GREEN?

While waiting for fuel shipments or any other solutions – temporary, of course – to the mobility crisis, the transportation scene is steadily changing around us. Of course pedestrian numbers are on the rise everywhere, but so are bicycles and scooters (including electric ones), skateboards, tuk-tuks (three-wheeled rickshaws), in addition to carpooling. These modes of transportation and the growing networks around them, born (or re-born) out of economic necessity, are rapidly enhancing the informal mobility sector and erasing old prejudices and stigmas associated with them.

Bicycles are the first thing that comes to mind when talking about green mobility and, yes, they are now increasingly out there, but there is only so much ground they can cover, so to speak. First, they require physical effort, which excludes several segments of the population, notably the elderly and physically challenged, but also people residing far from their place of work. Lack of proper urbanization standards in large cities, the dearth of green and public spaces, and the poor condition of the road network make it near-impossible to establish safe bike lanes. With the current economic crisis and devaluation of the Lebanese pound, purchasing a bicycle is also no longer within reach of some.

> A rebound in car sales [is] highly unlikely since Lebanese consumers are seeing their purchasing power continue to shrink

The local bicycle market is not a huge one, due to the abovementioned reasons, but Zeina Hawa, co-founder of The Chain Effect non-governmental organization, and a fixture in Lebanon's cycling scene, says demand for bicycles had been on the rise even before 2019. During the COVID-19 lockdown, mobility restrictions contributed to increas-

Successive government policies since the 70's have consistently promoted vehicle ownership and individual mobility, at the expense of shared transport

ing demand. To make bicycles more affordable, The Chain Effect organized a fundraiser to purchase bicycles and resell them at a lower price to locals who expressed interest.

"We are constantly working on removing some of the barriers for bicycle adoption in Lebanon. We are solutions-oriented and looking for practical interventions. Now is the right time to do this," Hawa tells Eecutive. Awareness is a big part of what The Chain Effect does. For over 5 years now, the community-based organization has been working on promoting the bicycle as a sustainable and convenient form of transportation. Over the years, their awareness efforts have materialized into festivals and events like "Ride your bike to work day." They have also worked on promoting bicycle-friendly routes and enhancing the urban appeal and functions of areas used by cyclists, notably through brightly-colored graffiti across the cityscape, proclaiming positive messages such as this one on a traffic-heavy road: "If you rode a bike, you'd already be there by now."

"Wave" electric bicycles are a very recent addition to the cycling landscape. These rechargeable vehicles are equipped with a battery that provides pedaling support to cyclists, reducing the amount of effort they need to ride to work or run errands. Incubated by Berytech through the European-funded Green Impact MED (GIMED) project, Wave is the brain child of Dutch entrepreneur Jan Willem de Coo, who originally thought of the model as a way to reduce commuting time by avoiding traffic and parking hassles in Beirut. Wave financed its first fleet of bicycles through donations from the team's family and friends, supplemented by small-scale Lebanese investors. With the project gaining momentum, Wave received a significant grant from the Dutch government, which propelled the company towards finally opening for business in March 2021.

The startup's entire first batch of 70-odd vehicles has been rented out since the first month; meanwhile the waiting list of eager customers continues to grow. By 2022, Wave hopes to grow its fleet with an additional 250 electronic bicycles.

Unlike "Loop," a popular electric scooter rental service that specializes in rentals for one-off trips, Wave is a long-term subscription service, renting its bicycles for at least one month. Eva Lattouf, customer success manager at Wave, explains that their focus was different from the outset. "The majority of our customers are long-term subscribers that have really opted adopted the bicycle as a daily mode of transportation," she says. As at October 2021, the subscription fee amounts to LBP 620,000, which Lattouf says is still affordable compared, for example, with the price of paying for two "service" cab rides every day. "The crisis didn't prompt our subscribers' choices; the demand was already there. Awareness of the benefits of bicycle riding had grown organically in Lebanon thanks to the work of

other associations and groups, like the Riders' Rights association and The Chain Effect, so we were addressing an already converted audience." This collaboration is ongoing and focuses on plotting bicycle-friendly routes and tips, as well as publishing awareness and safety videos.

A SERIES OF WRONG TURNS

One key element is still missing from the above to paint a comprehensive picture of transportation in Lebanon: shared transport.

While more people reeling from the high prices of gasoline (when available) and car parts are resorting to shared transport, this subsector is suffering from poor policymaking and the social stigmas associated with it.

In March 2020, buses, vans and other modes of shared transport in Lebanon were virtually grounded and had to abide by a limited number of passengers in early efforts to prevent the spread of COVID-19. Hamad Hassan, then-Minister of Public Health, defended this measure in a TV interview, saying that it only affected poor people who, in his view, were the only ones using shared transport. This was an unnecessary decision, according to Chadi Farraj, co-founder of the Riders' Rights civil society organization, and further hurt the reputation of the system. Unlike Lebanon, many European countries, and even the Wuhan province in the People's Republic of China, kept their public transport systems running at the time. "Studies in Germany and France showed that aeration and mask-wearing drastically reduce the chances of contagion in shared vehicles," Faraj tells Executive. Riders' Rights sought to reduce the fallout from the policy in Lebanon by training drivers and raising awareness among passengers, as well as distributing masks.

For Faraj, such an attitude to shared transport is unsurprising. He draws a picture of how successive government policies since the 70's have consistently promoted vehicle ownership and individual mobility, at the expense of shared transport. The media has also given little to no attention to the issue, further contributing to the systemic (and willful?) disintegration of the shared transport system and its branding as a means of transportation "only for the poor or second class citizens, run by mafia-like gangs."

To be blunt, there are simply too many cars in circulation – a problem often cited when discussing road infrastructure problems. In a recent blog post, Faraj cites the Council for Development and Reconstruction that estimated car ownership in Lebanon at 80 percent in 2013. In parallel, other means of transportation, including walking, shared transport, and informal systems, accounted for less than 30 percent of all commutes. According to Lebanese Customs, car imports between 2016 and 2018 averaged $1.2 billion annually, before plummeting to $210 million in 2020. Furthermore, between 2000 and 2020, banks issued a total of 73,000 car loans.

The state used to derive direct benefits from this state of affairs through customs and mechanic fees, as well as traffic fines, but most importantly through the allocation of road infrastructure and maintenance contracts to politically-backed companies, explains Faraj. Things have gotten to a point where the Ministry of Public Works and Transport is derogatorily referred to as the "Ministry of Public Works" only, he shares. Former Minister of Public Works and Transport, Youssef Fenianos, seemed well aware of that when he inaugurated a joint transport project in Byblos in 2019 and declared: "Lebanon needs a Ministry of Transport, not a Ministry of Works."

> "We now see a better representation of Lebanese society in the shared transport system [...] People are seeing cars as a burden, not an

MIGRATING TO INFORMAL TRANSPORTATION

Too many car owners now suffer from too many and too well-known problems in the sector, and are therefore turning to other solutions they can still afford. "We now see a better representation of Lebanese society in the shared transport system, the shame associated with it has dissolved. People are seeing cars as a burden, not an asset," says Faraj.

It derives that shared transport, including more informal alternatives, is rapidly gaining adoption. Unlike hybrid cars, bicycles and tuk-tuks are witnessing a noticeable increase in demand thanks to their comparative affordability for larger segments of the population. Once the brand of poor or rural neighborhoods, tuk-tuks running on rechargeable batteries are now more widespread. Originally used to transport goods or for short commutes in tourist areas, they are taking on more versatile roles, from street food stalls to shared passenger vehicles, and are even being used instead of cars. Because these vehicles do not consume fuel, the price of a fare remains low compared to other more conventional means of shared transport, constituting an attractive option for many.

There is also some buzz around reviving Lebanon's railroad network and tramway service, abandoned since 1975. On the ground, the Train-Train association has been lobbying for this cause since the withdrawal of Syrian troops from Lebanon in 2005, and has presented studies to the State Railway Authority. The president and general manager of the State Railway Authority, Ziad Nasr, met with newly appointed Minister of Public Works and Transport, Michel Najjar, to ask to prioritize the railroad network and tramway lines. In a visit to Paris, Prime Minister Najib Mikati even discussed the issue with French President Emmanuel Macron.

Resolving the many crisis Lebanon faces will require time, and the shift to shared and informal transport will likely continue to grow. A more durable long-term solution would be to encourage these sub-sectors so they can increase their coverage and satisfy demand. After his tirade against transport policies, Faraj laments the resurgence of car ads on billboards. Following his thread of logic, even advertising hybrid cars would be compounding to the problem of excessive vehicle ownership and the negligence of shared transport. When the crisis hopefully ends, it is important not to relapse into old habits, and this requires building and improving on the alternatives that have started to take root today.

Rather than wait for a sensible and achievable plan from the government to address the problem of transport, decentralized solutions are leading change. Individual enterprises and, more importantly, the support and engagement of municipalities, are key to ensuring the success of the shared transport trend. Eighteen months after its announcement and delays attributed to the COVID-19 pandemic, the joint transport project in Byblos mentioned above finally kicked off on October 3, 2021. The project aims at providing bus routes throughout the Byblos district. Similar localized systems can help shape a new vision of transportation, one that is affordable, convenient, environment-friendly, and light on the national fuel bill.

The migration of commuters to shared and informal transport needs to be managed. There are still many people unfamiliar with the dynamics of this system. To complement their "Bus Map Project" ongoing awareness campaign, Riders' Rights established a community-run social media hotline where neophytes can ask for advice and guidance on shared transport options. This initiative aligns with other awareness campaigns run by The Chain Effect, Train-Train, and similar organizations.

Perhaps one day the new transport system will act as the cornerstone for sensible urban planning in Lebanon.

CAPITAL CONCEPT S.A.L.

STRATEGY - FINANCE - GOVERNANCE

By Salah M. Tabbara

LEFT IN THE WIND FOR NOW

Lebanon's wind farm project is still waiting to take off

In February 2018, the Ministry of Energy and Water, representing the Government of Lebanon, had signed Power Purchasing Agreements with three wind farm developers for the development, installation, and operation of wind power generators in the Akkar region with a cumulative capacity of wind power of 226 MW. According to the terms of the agreement, the first units of power produced by these projects were supposed to be injected into the national electricity grid, and not a moment too soon, considering the current state of the electricity sector in the country.

Sadly, the project was delayed and has not seriously kicked off to date. The present financing difficulties make it unlikely it will resume unless outside funding is secured.

If the project were to be carried out, it would generate more than 800 million kWh of power annually, enough to power 200,000 Lebanese homes, operating over the hills and ridges of Akkar. It would employ in excess of 600 people during the construction period, mostly comprising local talents and skills, and provide stable rent incomes to dozens of landowners and several municipalities over the 20-year period of the agreement.

A VISION BLOWN IN THE WIND

Against all odds, the plan was, and still is, to build a state-of-the-art power generation project in one of the most pristine areas in Lebanon: Akkar. We, as developers, dreamt big. In addition to the wind farm, our vision includes an eco-tourism attraction that celebrates the history of the region and integrates hopes for the future. This consists of a leisure and educational hub that brings people from all over the country. A learning center offers resources to schools and community groups, as well as educational activities. The site also includes 40 kilometers of biking trails, as well as multi-purpose graded trails built from the recycled waste gener-

ated during construction are intended for picnics, sightseeing, and events planning.

Yes, it is a mega infrastructure project but one with a clear and beneficial social and environmental footprint.

Unfortunately, that did not happen. By end 2019, and after the project had secured early on letters of intent from international supporting financing parties, the abrupt financial meltdown occurred, with its devastating consequences on all levels, consequences with which we are all too familiar.

Where do we go from here? Shall we, as private sector investors call it quits? Shall we give up after preparing all the necessary studies and investing vast amounts of money to de-risk the electricity sector in Lebanon, to secure the necessary land for the wind farm project and keep them secured even up to this day?

ACTION NOW

There is no question about it: Lebanon needs power desperately. We are ready to resume our enterprise. Give us stability and the wind farms will be up and running in 18 months.

What is needed for this?

Immediate action and at a large scale. We need to move ahead with renewable energy projects. This is not limited to wind farms but also includes solar power projects.

Ideas for financing are always available if we think collectively outside of the box. Carol Ayat, a respected energy finance professional and investment banker, has presented an innovative plan in that regard (see story page 40). Her paper on a new funding model to finance electricity projects across generation, transmission, and distribution deserves serious stakeholder discussion. Her win-win proposal opens up the possibility for depositors in the Lebanese banking sector to invest their "lollars" in such projects. The central bank Banque du Liban (BDL) would swap these "lollars" with part of the remaining hard currency it still holds to finance these projects.

We are ready to resume our enterprise. Give us stability and the wind farms will be up and running in 18 months

Another idea worth considering is for the Government of Lebanon to explore the possibility of using part of the International Monetary Fund's newly allocated Special Drawing Rights to Lebanon to provide either soft loans and/or the necessary guarantees for such projects to get financed. By that scheme, the Government would invest this money and achieve returns on it.

We need to vamp up renewable energy. We need to start and finish the wind farm project we started eight years ago.

Salah M. Tabbara is the chairman and general manager of Sustainable Akkar

By Rita Khawand and Wael Yammine

In collaboration with
KONRAD ADENAUER STIFTUNG

BLACK GOLD

Transforming waste into food security

Although it is a productive sector, agriculture in Lebanon relies heavily on imports of primary resources and materials. Most commercial agricultural production requires imported basic materials such as seeds, potting mixes, chemical fertilizers and pesticides, many of which are not produced locally or in sufficient quantities. The devaluation of the Lebanese pound poses a serious challenge to both the flow of these imports and the purchase of fuel to power the machinery necessary to manage large fields. The increased costs of agricultural production are raising the cost of produce and threatening food security.

According to a recent paper authored by Kanj Hamade, assistant professor of agricultural economics and rural development at the Lebanese University, and published by Carnegie Middle East Center, sales of agricultural inputs and services contracted by 40 percent on average in 2020. In response to the economic crisis, farmers have been increasingly adopting cost-reduction strategies involving mainly reducing the use of fertilizers and other inputs, relying on local seeds and nurseries, and overall decreasing agricultural activities and spaces.

In response, growers are being forced to adapt by resorting to local alternatives or switching from conventional systems to new and more sustainable ways of producing food. The most logical, and most exciting place to start this is the soil itself and what makes it fertile. One key agricultural component in this shift to self-reliance remains undersupplied and undervalued: a trusted local supply of good quality compost, the best type of organic fertilizer.

DEADLY ECONOMICS

Some technical talk is necessary to emphasize the importance of fertilizers here, but we'll try to keep it simple. Fertilizers are either chemical-based (synthesized in labs) or organic-based, i.e. made from organic materials only, although not necessarily carrying an organic certification. Organic fertilizers usually consist of pure raw or cured manure, or naturally decomposed agricultural byproducts and food waste (compost), or mixes of both.

Basically, conventional growers who rely on chemical fertilizers usually focus on single cash crops such as tobacco or tomatoes. Repeating the growth cycle of these uniform crops eventually drains the soil of nutrients, hence the need for imported fertilizers to maintain or increase yield. Such fertilizers contain Nitrogen, Phosphorous, and Potassium (NPK) in the form of salts that increase soil salinity.

Common chemical fertilizers contain compounds that are technically safe to use but can create devastating reactions if not stored properly. One of these compounds is the infamous ammonium nitrate that caused the August 4 Beirut Port explosion. This compound had previously caused similar explosions in other countries, and had even been used in terrorist acts, leading many countries to ban it or ban the sale of fertilizers containing it in high concentrations.

Also, ensuring that only the desired crops grow and benefit from fertilizers requires eliminating the competition from weeds, which requires more imported chemicals in the form of herbicides. These herbicides do more than eliminate unwanted growth, they also contribute to barren soils by depopulating microbial life in soils. The crops that

grow on such impoverished plots face a higher risk of disease, and their uniformity and concentration attracts pests that thrive on them. As a result, they require more inputs in the form of more water or more fertilizers, as well as additional chemical inputs through the use of imported pesticides. And with the next crop, the cycle is repeated and intensified.

This sadly literal self-sabotage brings to mind a fitting quote from Franklin D. Roosevelt often used among practitioners of chemical-free agriculture: "The nation that destroys its soil destroys itself."

In 2020, imports of fertilizers dropped to $27 million, half their value from previous years. While importers and producers of chemical products may still turn profits, growers' pains endure and worsen; even prior to the economic crisis, they complained about smaller yields year-on-year and the spread of diseases, despite using the same quantities of inputs, or sometimes increasing them. When everything fails, these growers go back to the chorus of blaming climate change or the "original infertility" of the land.

TRANSITIONING TO ORGANIC SOLUTIONS

A chemical-free agricultural production carries with it a number of advantages in terms of budget, quality, profitability, and more importantly, sustainability.

From a fertilizer standpoint only, there are important savings to be made from establishing local production facilities. A search for quotations among local suppliers of fertilizers reveals telling figures. The price of a 25 kg bag of imported chemical fertilizer is $17. This type of fertilizer requires lab equipment and a supply of raw materials not available locally. The price of a same-quantity bag of organic fertilizer comes out at $9 or $10 on the cheaper side (imported from Belgium and The Netherlands, respectively) and $14 on the higher side (imported from Turkey). By comparison, a similar bag of locally-made compost ranges between $3.5 for lower-grade products and $8.75 for high-end ones. The cost-benefit ratio is crystal clear.

Most importantly, chemical fertilizers contribute to the degradation of soils, something many conventional growers are still unaware of or unwilling to do anything about, and this raises the bill of additional inputs required.

Organic fertilizers, on the other hand, play a huge role in contributing to food security through the preservation of soil health and fertility, thereby ensuring stable yields and sustainable agricultural production. By that measure, good quality compost is best type of organic fertilizer. Compost is the result of aerobic decomposition by microbes of different types of organic material (food scraps, tree leaves, manure, seeds, etc.). A good quality compost is supposed to feed the soil not the plants, meaning it inoculates the depleted or struggling soil with the needed micro-organisms which in turn will harvest the essential nutrients from underground and offer them to the plants. The plants in return give back sugar to the microorganisms, establishing a synergistic relationship that helps them become more resilient. In addition to bringing back life to degraded soils, compost helps build soil structure, retain moisture, and prevent erosion. It can also serve as an alternative disease-free potting medium for nurseries, replacing the imported peat moss that depletes wetlands in many parts of Europe (and also costs a bundle for local importers).

Organic fertilizers [...] play a huge role in contributing to food security through the preservation of soil health

Of the different compost production systems, thermal composting is the most widespread worldwide. Without getting too technical, this process combines regular aeration and moisture control to heat careful proportions of materials to above 55° C over a period of 10-15 days, eliminating most pathogens and weed seeds. This curing process makes the resulting compost ideally suited for use as a potting mix for plant nurseries or as a soil amendment.

Other systems necessitate more time and deliver end-products with different properties intended for different applications. Static composting, for

example, takes up to six months and requires different conditions under which insects and microorganisms slowly decompose matter into "humus" mainly intended for environmental applications. Cold composting relies on the action of certain insects only to produce a rich soil-amending compost (vermicompost) that is, however, unsuitable as a potting mix. This process is more sensitive and requires more efforts to guarantee ideal conditions, making it effort-intensive.

WASTING WASTE

Successive destructive policies since the 90's have been biased in favor of importers of chemical fertilizers. As a result, many large-scale growers and investors are convinced that feeding the population and reclaiming food security on a national level are impossible without chemical fertilizers. Sadly, many growers are not fully aware of, or do not care about the damage that chemical fertilizers cause.

With the onset of the crisis, however, reliance on chemical fertilizers is diminishing. Small-scale farmers especially are turning towards animal manure as an organic fertilizer after it had been gradually phased out by the overabundance of chemical fertilizers and their marketing as "odor-free."

On the other hand, a large number of growers are unaware of the importance and benefits of using compost as an organic fertilizer. This is partly because compost has been primarily associated with solutions to the waste crisis. Over the past few years, specifically after the waste crisis hit critical levels in 2015, several local entrepreneurs and non-governmental NGOs have begun focusing on developing compost value chains (collection, sorting, production) in Lebanon as a means to divert household organic waste from landfills, bearing in mind that this constitutes over 50 percent of total municipal solid waste in Lebanon, according to the German development agency GIZ. For example, Green Site Composting, located near the Beirut slaughterhouse, uses static composting, whereas Cedar Environmental applies enzymes to organic waste to speed up its decomposition. Even the former waste management company Sukleen used to operate a composting facility at its Medawar headquarters, although it was reluctant to share details about its operation.

These initiatives do not address the agriculture sector's needs; they are primarily environmental and focus on waste reduction, even if before 2015 less than 10 percent of total organic waste was composted. Due to the absence of adequate regulations, the compost produced may contain different contaminants, from weed seeds to pathogens and heavy metals. Some of it may be packed active and dried, which makes it seemingly odorless, but once it is exposed to moisture, it releases bad odors. Or it may be stored too long or in too dry conditions, rendering it sterile. It is not surprising then that its desirability in the agriculture sector is low, and it often ends up dumped erratically or distributed for free to growers insufficiently aware of its poor quality. For this reason, many growers find it easier to buy manure instead, since it is cheaper, more readily available, and offers the same results: bad odors and a high risk of pathogens.

There is an urgent need for local regulation of compost production processes, especially in terms of quality control

RETHINKING AGRICULTURE

This "waste" of what should otherwise constitute a boon to agriculture can easily be prevented. First, there is an urgent need for local regulation of compost production processes, especially in terms of quality control. Compost standards and guidelines exist in the US and EU countries and are either enforced by laws or through regulatory bodies. Lebanon's National Agriculture Strategy (NAS) 2020-2025, drafted in June 2020 by the Ministry of Agriculture and the Food and Agriculture Or-

ganization (FAO), actually calls for establishing a regulatory framework for the sector notably to encourage the use of renewable energy in the sector to mitigate the effects of climate change, including the production of compost from animal farms and agricultural products. This step is to be complemented by more effective awareness and communication campaigns on responsible food consumption.

When it comes to implementing this strategy, however, it is a different matter. This will require the willingness of international donors, which is conditional upon long-term and structural reforms. Some small-scale Lebanese farmers have already benefited from initiatives under the NAS, namely through the $10 million reallocated by the World Bank in May 2021 to support them with agricultural inputs and animal feed, and through an inputs voucher scheme implemented by the International Labor Organization and FAO in September and funded by the Netherlands.

Major reforms in the agricultural sector entail formalizing farming and animal husbandry–related businesses, as well as agricultural labor, in order to protect the rights of actors involved. Amending land tenure and heritage laws would also enforce clear and fair land-use regulations, including sustainable land management practices. Also, facilitating the creation of cooperatives and improving their independence and capacity to grow would favor the growth of socially enterprises and solidary businesses in the sector.

COMPOSTING FROM GRASS ROOTS

On a more pragmatic note, a key element of successful reforms and policies is the availability and transmission of the necessary skills and knowledge in agriculture, specifically in composting which is still not given enough attention. The SOILS Permaculture Association – Lebanon, has focused on composting since the beginning of the crisis in Lebanon. Educating and training growers on shifting away from chemicals to rely on more natural inputs proved to be incomplete when considering the difficulty of sourcing good quality compost locally. The community-based association then began integrating composting in all its agro-ecology training programs.

In the summer of 2021, the association partnered with the French organization Terre et Humanisme to support two trainees in starting up small-scale pilot composting units in the regions of Jezzine and Tyr, with the aim of creating and marketing a trusted local product for the agriculture sector. The trainees showed interest in the project as a way of diversifying their agricultural operations and creating a new and sustainable source of income that does not rely on imports. They were provided with the necessary knowledge, basic equipment, and mentoring in all steps of the process. Organic materials were sourced from within the trainees' home villages or neighboring areas, encouraging villagers to drop off or "donate" their agricultural waste to the compost producers rather than burning it. After the end-product is tested in demonstration plots, the compost will be sold at a competitive rate to growers.

A key element of successul reforms and policies is the availability and transmission of the necessary skills and knowledge in agriculture, specifically in composting

As the pilot phase of the project nears its end, it is clear that education and dedication are the key requirements to its success, together with a healthy dose of passion. The initial investment can be as low as $500 (covering equipment and material costs, as well as land fees) and can produce around 4-7 tons of compost every two months. Based on current market prices, 1 ton of this compost could sell for around $300. Production can be increased at little additional cost and create jobs to satisfy the growing labor needs. The sheer exhilaration of the trainees at learning about soil microbiology and unlocking its secrets through a better understanding of the relationship between healthy soils and healthy crops is a reward in itself. Already both trainees are sharing their newfound knowledge with their communities, lending much-valued support to awareness efforts by agro-ecology activists.

While waiting for much-needed reforms, such systems could start improving food security through soil health. They have proven to be effective at reinforcing solidarity and cooperation within communities when it comes to organizing the sourcing of organic raw materials. They could also play an important role in the production of certified organic produce that fetches higher prices in local and export markets. And, of course, it is good for the environment as it contributes to reducing waste and the risk of fires from burning such waste.

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